SCIENTIFIC AMERICAN

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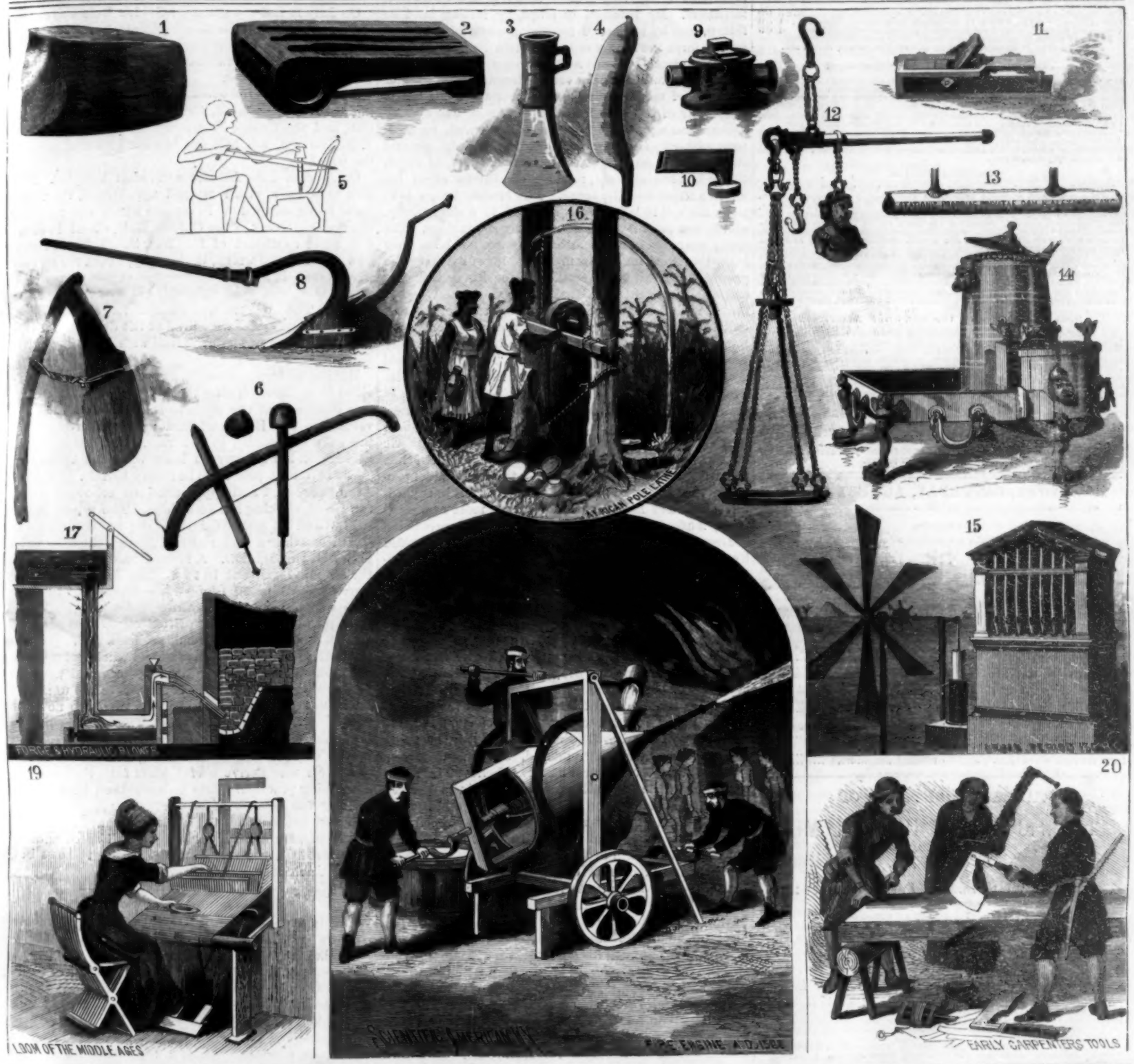

THE EVOLUTION OF HANDICRAFT.—[See page 108.]

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THE FARMER AND MODERN INVENTION.

In modern life one of the most striking features that has been and is being developed more and more rapidly is the interdependence of the members of the human family. As the population increases, the hermit or quasi-hermit life so frequent years ago, when the farmer for months in the winter saw hardly any faces except those of his own family, and when he conducted his farming operations in almost complete independence of the rest of the world, is fast becoming an impossibility. In old times the farm was a self-supporting world in itself. The wells, springs and cisterns supplied water; the domestic animals got all their food from it, and it produced its own fertilizers. By rotation of crops, by letting land lie fallow, and by the use of fertilizing material produced on the farm the land was kept fertile. Rain descended from the clouds without any human agency.

Now the conditions are very different. The greater demands of modern civilization militate against the simple life of the New England farmer of one or two generations ago. The farmer's children wish to compete with city children in education and in general culture. But outside of the personal aspect, of which this is but one element, modern conditions affect his life in a much broader sense. The tendency now is to work the soil in large areas devoted to a single crop, and to use machinery in all farming operations. For many years past the American inventor has been busy inventing most ingenious machines for cultivating the ground, for sowing the seed, and for harvesting the crops. On account of the inventor's work the Western farms, with fields of wheat reaching to the horizon, cultivated by steam-drawn plows, and whose crops are harvested by great machines drawn by teams of many horses, have become a possibility. The great cereal crop of the United States is due to the mechanical inventor.

In the same order of things is the modern fertilizer. For different crops different fertilizers are made in factories. As the great natural sources of phosphoric acid were overdrawn, the European agriculturist has utilized the finely ground slag of the basic steel process. The farmer depends no longer on his barnyard, but purchases his plant food in the most approved form, made in factories from the most unpromising sources of supply. The Atlantic coast is patrolled by steamers whose occupation is the catching of menhaden or bony fish. After the oil is extracted from these fish, the farmer has a claim on what is left as a source of nitrogen for his crops. South American nitrate of soda is another source of nitrogen. The German mines supply him with his potash, and the blending of all the elements is effected in the fertilizer factories, whose processes are guided by the most exact chemical analyses of their materials.

Even in the matter of local transportation the farmer is being taken care of. The electric road, to whose operations, heedless of vested rights, so many highways have been surrendered, bids fair to revolutionize the aspects of rural life. It is believed by many that the electric road will eventually haul the farmer's products to the cities or railroad stations, and the improvement of country roads has actually been discouraged by those who believe in the highest development of this form of traction.

Where the process of development of modern life will end, it is hard to see. The farmer, who would seem to be the last to be subjected to modern scientific advancements, is really, speaking relatively, the one most affected. Mechanical, chemical, and electrical science have changed his entire status. Among inventors the farm is recognized as the field for most useful work in invention. Man may yet learn to dispense with coal, and the steam engine may be relegated to the past. The self-contained energies of the cosmic system may yet be used to replace the motor which during the last decades has replaced them. Windmills and waterwheels represent the utilization of cosmic energy, and mankind may yet be driven to a more extensive use of the mechanical powers of nature. But for food production, it seems as if the soil for many years to come must be the only resource. Synthetic chemistry has to make enormous advances before it can produce palatable food. Already it has done something in producing glucose and saccharine as sugar substitutes, but until the synthesis on the large scale of carbon and hydrogen is effected, the synthetic chemistry will be inchoate.

In the modern march of progress the farmer will hold his own. The changes in his processes, the abolishment of the quiet rural life, and of the farm as an almost self-contained unit of existence, are brought about by the devotion to his interests of the enlightenment of the world, and the world in its turn is more and more dependent on him. His success or failure in the Western States affects the earning of the railroads, and through them the financial condition of the Eastern and European capitalist. The dependence of mankind on the past and present products of the soil is becoming more and more emphasized as modern science daily proves itself incapable of dispensing with the slow processes of nature. The field for science and invention in improving farm processes is one of the greatest. Mechanics and chemistry will, every year, take a larger part in the operations dependent on plant culture, and future years may yet see so systematic a system of farm and tree culture established that the entire country, with definite areas for particular crops, will seem but one great farm, whose fields will be represented by areas of many miles extent. As steam and chemistry now do their most important work in connection with the crops, electricity may yet supplant them, or re-enforce their operations.

A Vessel Difficult to Sink or Destroy.

On July 20 last the schooner Golden Rule was cut to the water's edge by the steamer Chattahoochee, which took off her crew of seven men and one passenger. She was then off South Nantucket Shoals, from Ponce for Boston, with molasses.

Since that time the wrecked schooner has been floating about on the coast, forming a danger to navigation, and the United States cruiser Atlanta, Captain J. R. Bartlett, was sent out to search for and destroy the wreck.

On August 4 the Atlanta arrived at Newport. Her bow presents a much marred appearance, the white paint being scraped off in streaks where she rammed the floating wreck of the Golden Rule, about twenty-five miles southeast of the New South Shoal light. She sighted the wreck, bottom up, about 100 feet off her course. It had the appearance of being anchored by the bow, and was a dangerous obstruction to navigation. The Atlanta was cleared for action, and a couple of broadsides were fired at the derelict, but the shot went clear through the hull without doing much damage.

Having no torpedoes on board, Captain Bartlett decided to try the ramming tactics. First a light blow was delivered at the stern to see what condition the vessel was in. She was found to be practically new, but gave way readily to the ram. Another blow was made upon her quarter to learn what her cargo consisted of, and it proved to be empty barrels. Next the Atlanta drew off and approached the schooner under full speed, striking her amidships. The schooner was so light and the ram so deep that she was thrown away from the Atlanta and righted, though the blow cut a gash half through her. A second ram was made, and the schooner was cut in two. The Atlanta's engines were disabled, being in poor condition, and the warship was obliged to withdraw under sail, while the stern post of the schooner drifted off toward George's Banks, and the bow still remained anchored. Captain Bartlett would have destroyed the whole craft if possible, but the crippled condition of his vessel prevented. About two hours were consumed in the work.

The net results appear to be that there are now two floating wrecks instead of one. The problem how to build an unsinkable ship appears to have been realized in the case of the Golden Rule, and perhaps naval architects may derive useful hints from the example. Something practical seems to have been learned concerning the Atlanta as a ram, which is that her engines are not suited to the work. We have had examples of passenger steamers going at full speed against solid icebergs, the result being damage to bows but not to machinery.

Depreciation of a Canal.

The Somersetshire Coal Canal was put up for sale recently at Tokenhouse Yard. The canal is about 10½ miles in length. The actual rents received from the cottages and surplus lands amount to about £75 per annum. The canal was opened in 1800. It had a prosperous career down to 1872, at which time tolls were taken on 157,000 tons yearly. From 1884 to 1888 the tonnage was taken on a yearly average of about 24,000 tons, producing £1,547 in tolls, while the average yearly expenditure was £1,284. In 1889 considerable difficulties were caused by strikes, etc., and the collieries feeding the canal remained idle for some time. This state of things occurred more or less in subsequent years, and the company eventually went into liquidation. The original cost of the canal was about £200,000, and the auctioneer said that a bid of £20,000 would not be refused. A railway company was, he said, almost certain to acquire the property sooner or later, but it afforded opportunities in connection with many speculative undertakings. The highest bid was only £3,900, and the auctioneer withdrew the property from sale.

Enlistments in the United States Army.

The law approved February 27, 1893, provides that all enlistments in the army shall be for the term of three years, and no soldier shall be again enlisted in the army whose service during his last preceding term of enlistment has not been honest and faithful; and in time of peace no person who is not a citizen of the United States, or who has not made legal declaration of his intention to become a citizen of the United States, or who cannot speak, read, and write the English language, or who is over thirty years of age, shall be enlisted for the first enlistment in the army.

The Modern Incandescent Lamp.

L'Industrie Electrique contains a very full account of a communication delivered on June 6 by M. Larnaude before the Société International des Electriciens. The title of the article, says the Electrical Review, conveys to the mind the hope that the communication would contain new and important information on this subject, but its real purport is rather to set forth in a popular manner a comparison between modern attainments in lamp manufacture and the attainments reached some years ago, manufacturing details being wholly omitted.

M. Larnaude, who is the technical expert of the French Edison-Swan Company, commences by referring to the price of incandescent lamps. Only a few years ago the usual price at which it was sold was 5 francs, whereas now the price is only 1 franc; and, further, the quality of the cheap lamp of to-day is far superior to its more expensive predecessor. Several causes have brought about the perfection which has now been arrived at, to wit, competition with other illuminants and the general demand for electric incandescent lighting; but in the factory, the principal reason which has enabled the lamp to be made at so reduced a price lies in the perfection of detail in the various processes and the small amount of waste which now attends the manufacture. Formerly, to make 1,000 uniform lamps of a given voltage and candle power, it was necessary to start making 4,000 or 5,000 lamps, while to-day the waste is reduced to about 10 per cent. The price of the lamp is now so low that any further reduction that may in the future be effected will be quite insignificant to the consumer. What is of importance, however, to the consumer, is the return of light which he obtains from his lamp and the current it consumes. By tables such as have often been printed, it was demonstrated how the cost of the current formed a far more important item than that of the lamp. It was therefore economical to run the lamps brightly at the sacrifice of their lives. But unfortunately a third factor enters—the lowering of the candle power as a result of the blackening of the bulb and the disintegration of the filament. M. Larnaude has ascertained in an interesting manner that the depreciation in illuminating power is due in about equal proportion to those two causes. His method of investigation is to first measure a lamp on the photometer, and then, after it has become blackened by use and the diminution in illuminating power has been noted, to slowly let the air into the bulb by cracking off the pip. He then exposes the bulb to about a red heat (how, he does not say, but presumably by turning it about in a blowpipe flame), when the thin film of carbon burns away, the bulb becoming clear again. The lamp is finally re-exhausted and remeasured on the photometer. With old types of blackened lamps he has found the loss of light due to the carbon film to amount to 25 per cent to 30 per cent. In some instances the blackening may be due to special causes, but there can be no doubt that the usual phenomenon is the projection of particles from the filament. Owing to the perfection of the processes now employed, the blackening of lamps has been much decreased, and instead of forming rapidly in the early part of the run, the film now forms slowly and equally throughout the life of the lamp. As regards specific consumption of energy, the old types of lamps were started at 4 watts per C. P., and this rose after a run of 500 hours to 6 watts per C. P., and to 7 watts after 1,000 hours. Now it is common to find lamps which start at 2·5 to 3 watts per candle, and do not exceed 3·5 watts after a run of 400 to 500 hours. At about this point it attains its economical limit of age as defined by Mr. O'Keenan a few years ago. In connection with economy of using lamps, M. Larnaude says that if two lamps are giving the same candle power according to photometric measurement, but are running respectively at different watts per candle, the brighter one will be more agreeable to the eye, and at the same time will appear to give sensibly more light. Every one, however, will not, we think, agree with the former of these contentions.

The various parts of the lamp are next considered. The filament is naturally the most important of these. Two conditions are essential: one is that the substance must conduct electricity, the other that it must stand a high temperature without fusing or changing in an appreciable manner. The hope is expressed that through the researches of M. Moissan it may eventually be possible to use for the incandescent medium certain homogeneous compounds of carbon with other elements, such as silicide of carbon. But so far nothing has been employed on a commercial scale excepting carbon. Up to a few years ago the carbons usually employed were made from vegetable fibers, either natural as used by Edison, or parchmentized cotton, as devised by Swan. Owing, however, to the lack of thorough homogeneity and uniformity of size of the carbons, the lamps were not very satisfactory or uniform, and the breakage during manufacture was heavy. It was true that the flashing or heating process, i. e., heating a filament in a hydrocarbon gas or vapor, cured many evils of the foundation carbons; but at best it was only a palliative, and the evils were not cured as well as might appear at first sight. The root of the matter was to get a homogeneous foundation of hard and elastic carbon. This is usually done now by completely dissolving the vegetable or other compound containing carbon, and squirting the solution into a liquid which precipitates the material in the form of a homogeneous thread of uniform size. Or the material may be precipitated from solution in the form of sheets, and the sheets then shred into lengths of the requisite size. Another method, which it seems is being successfully employed, is, make a paste of finely divided carbon, with some decomposable binding material, and squirt the paste by means of pressure. The modern homogeneous carbon used for filaments has a much lower specific resistance and higher specific gravity than the carbon formerly employed. Owing to the hardness, the breakage in manufacture is slight, premature fracture of the filaments in the lamps is greatly diminished, and the lamps may be run at a higher temperature.

Various other technical points were next briefly touched upon, such as the calibration of filaments, the considerations attending the manufacture of lamps of small candle power at high voltage, multiple filament lamps, and, finally, the most recent development of incandescent lighting, viz., lamps of large candle power. Light for light, this latter type of lamp costs about double that of the arc lamp, but it possesses many advantages over its more economical rival. It requires no attention, and it can be placed in any position and used exactly where it is needed. It can be lit up and extinguished without trouble, gives a perfectly steady light, requires no enveloping shade, and produces a pleasanter light than the arc lamp.

With regard to the bulbs, which were formerly often blown in the blowpipe from tubing, the universal practice now is to blow them in a mould. The pumps used for exhausting the lamps are now very perfect, and consist of a combination of a preliminary exhaust by means of a mechanical pump, and then completed by means of the mercury pump, the whole being worked automatically by mechanical power. Finally, the leading-in wires which pass through the glass are always of platinum, though the length is now reduced to the smallest possible amount, the filament being supported by some other cheaper metal.

Black Hills Minerals.

REV. H. T. CROSS.

Last June I spent a two weeks' vacation collecting minerals in the Black Hills of South Dakota. I was impressed with two things, the lack of many minerals found in Colorado and the great abundance of a few species. I found many specimens, but not many different species. I will mention such as I found.

Quartz.—The granites among the archean rocks are exceedingly coarse. There is plenty of quartz, but quartz crystals are scarce. I saw a few small smoky ones found within the town limits of Custer. I saw quartz crystals in Wind Cave. In Spearfish Canon I found fine drusy quartz and a few quartz geodes. I also found coarsely crystallized quartz embedded in mica. Beautiful massive rose quartz is found in veins among the archean rocks. The finest is found near Custer. In many yards in Custer there are rockeries that are richly colored with specimens of it. Pieces of good rose quartz give life and color, like Brazilian agates, to a collection. To my eyes it has the same restful effect as fire opal. Near Custer I found some beautiful fragments of transparent opaline quartz, which I think would cut nicely.

Mica.—This mineral is very abundant in the Hills. Many mines have been opened and some of them extensively worked. At the Lost Bonanza mine, near Custer, there were many tons on the dump waiting the completion of the axle grease works at Custer. It was of too poor a quality for other uses. I found many specimens with embedded tourmaline. At a mica mine near Sylvan Lake I found a curious combination of black mica (biotite) and muscovite in the same plates. The line of separation between the two varieties is generally well defined, both on the surface of the mica plate and also between the layers. The biotite seems to be embedded in the muscovite. They make interesting specimens.

Tourmaline.—This mineral is very abundant among the archean rocks. In many places it is found in large masses. The crystals are much like those found in white quartz near Puma Pass in Colorado. The prism has twelve planes with a low, three-sided, beveled termination. I found very few doubly terminated crystals. Many of the prisms taper to a point, like many of the Colorado smoky quartz crystals. They are not, however, very regular or smooth. I saw one such tapering crystal a foot and a half long. It is the first time that I have ever found tourmaline tapering. In one specimen that I found the crystals are about the size of a pipe stem, and are so thickly arranged, parallel to each other, that in a space of eight inches square are seen the ends of some sixty crystals.

At the Lost Bonanza mine I found fine specimens of tourmaline embedded in mica, with occasional instances of mica embedded in the tourmaline. The crystals are flattened between the layers of mica, and some of them are so thin that they are transparent. They will serve me in the place of smoked glass for looking at the sun. The terminations of these crystals are generally misshapen and flat. In one place at least, the New York mine, dark green tourmaline is found in a greenish mica. The smaller crystals are transparent. I secured a few specimens only.

Garnets.—In the gulch mines around Custer are found vast numbers of very small garnets. They come from decomposed mica-schist, and are found in the tailings of the washings. They are heavy and settle to the bottom along with the gold and stream tin. The largest one that we found is about a half inch in diameter, but most of them are so small that they are seen to best advantage under a common pocket magnifying glass. Thus seen they are very beautiful, being blood red, and some of them having twenty-four sides. Many of them have been worn into perfect spheres. A vial full of this garnet sand makes a good specimen for one's collection. In the neighborhood where they are found everybody calls them rubies. Larger garnets, but not very perfect ones, are found in the rock not far from Custer. Very perfect small garnets were found in the bottom of a spring.

Calcite.—In the streets of Deadwood I found limestone containing small cavities lined with calcite crystals. In the rock thrown out from a railroad cut in Spearfish Canon I found fine clusters of calcite in the same place that I found drusy quartz. In a bed of shale in the same canon I found good geodes of calcite. The shell of the geodes is composed of iron and quartz. Some of them contain only quartz crystals, or quartz with calcite crystals deposited on their surface. In Wind Cave, near Hot Springs, I saw many beautiful calcite geodes, but could, of course, secure them only by purchase or exchange. These geodes and the beautiful box-work formation seem peculiar to that cave, in which I saw very few stalactites. Crystal Cave, which I was unable to visit, is about twenty miles from Deadwood. It has very extensive and beautiful deposits of dog tooth spar. Various forms of calcite crystallizations are found in the Bad Lands, near the Black Hills.

Gypsum is abundant in the "Red Valley," which extends around the Hills, but selenite or crystallized gypsum is not very common.

In the gold gravel in Warren's Gulch I found one good crystal of staurotide. Tin and gold are found all through that region, but neither of them in immense quantities. My boy, however, who was with me, picked up in the streets of Custer a piece of quartz that was rich in free gold.

Cost of War and Education.

There is no better proof, says the Journal of Education, of the essential barbarism of even the most civilized nations of the world than is afforded by a comparison of the money they expend for the maintenance of physical supremacy as against the expenditure for mental improvement. Though it be assumed that brain is better than brawn, there is no evidence that statesmen so regard it. In some tables recently compiled, the amount per capita expended by various governments for military and educational purposes is set down as follows:

	Military.	Education.
France	$4 00	$0 70
England	3 73	62
Holland	3 58	64
Saxony	2 36	38
Wurtemberg	2 38	38
Bavaria	2 38	40
Prussia	2 04	50
Russia	2 04	3
Denmark	1 76	94
Italy	1 52	36
Belgium	1 38	46
Austria	1 36	32
Switzerland	92	84
United States	80	1 35

Memory of Movement.

Dr. Schneider, of Jurieff (Dorpat), acting on the advice of Professor Ciz, has made a series of observations on the effect of the lapse of time upon the memory of movements. These are published as a graduation dissertation (in Russian). The method adopted was to fix the right arm of an intelligent person so that only the wrist could move, and to tie a pencil to the forefinger so that a curved line could be marked on a piece of paper ruled in millimeters. The person was blindfolded and requested to draw a line, and, after a definite interval of time, he was asked to draw another as nearly as possible of similar length; the length of this was compared with that of the first line and the error noted. Altogether 4,000 experiments were made with three individuals, the mean error after half a minute being one twenty ninth; after two minutes, one twenty-eighth; after six minutes, one twenty-fourth; after ten minutes, one twenty-first; after fifteen minutes, one seventeenth of the length of the original stroke; thus showing that the memory of movements grows rapidly less and less accurate even during the first few succeeding minutes.

IMPROVEMENTS IN TELEPHONES.

Our engravings represent some new forms of telephonic instruments recently brought out by Mr. Eloy Noriega, of the city of Mexico, Mexico. In Fig. 1 is shown a combined telephone transmitter and receiver, in which the instruments are united in such a manner that while the transmitter is held to the mouth in position for receiving speech, the receiver will be pressed against the ear.

The receiver is provided with an iron diaphragm

NORIEGA'S COMBINED TELEPHONE RECEIVER AND TRANSMITTER.

which is acted upon by a U magnet concealed in the handle and provided with oblong pole pieces formed of short iron rods and surrounded by oblong bobbins. By means of this construction a powerful magnetic field is formed, which is sensitive to slight impulses, and therefore effective in reproducing sounds uttered in the transmitter.

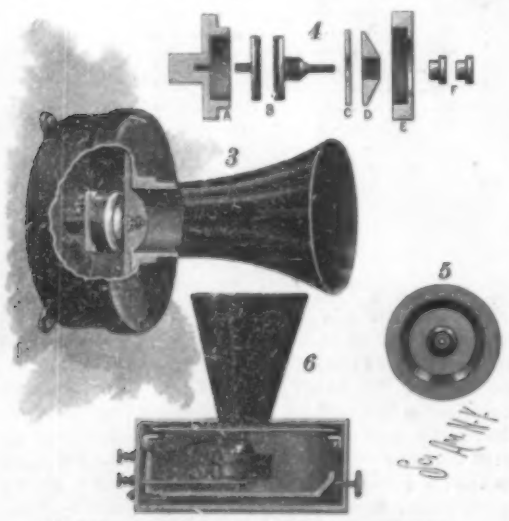
The transmitter used in this instrument is provided with a diaphragm of resonant wood, such as pine or spruce, with a covering of mica on opposite sides, and a binding of elastic rubber around the edge to protect the wood from moisture.

To the diaphragm are attached two perforated carbon bars, in which are loosely inserted the ends of two carbon rods. A cross bar inserted in the carbon bars between the carbon rods carries a brush of horsehairs or analogous material, which presses the carbon rods outward away from the diaphragm and into contact with the outer walls of the holes in the carbon bars, as shown in Fig. 2.

The carbon bars are connected up in the primary circuit of the local battery, and the receiver bobbins are connected with the secondary or line circuit.

The variations of resistance, due to the vibration of the carbon rods in the carbon bars carried by the diaphragm, causes pulsations which are reproduced in the receiver.

In Figs. 4 and 5 are shown two forms of transmitter employing a carbon button or granulated carbon placed between carbon or metallic disks, one of which is stationary, while the other is vibrated by the diaphragm when the instrument is in use. In Fig. 4 the



NORIEGA'S MICROPHONIC TRANSMITTER.

several parts of the button are shown in the order in which they are assembled, the carbon button or granulated carbon being placed between the disks, B. A side elevation of the complete button is shown in Fig. 5. In Fig. 6 the cell just described is supported by a spring attached to an adjustable lever secured to one side of the diaphragm cell and adjustable by a screw passing through the opposite wall of the cell.

The same lever carries a flexible spring, having at its free end a stud which rests upon the diaphragm and presses upon the center of the button. In each case the disk adjoining the diaphragm is slightly movable, like a piston, in the cell in which it is placed.

The kind of carbon preferred by the inventor is that prepared by a peculiar coking process from anthracite coal. This instrument is designed for long distance work, and is constructed with a view to using heavy currents.

Removal of Shops.

General Manager Broughton, of the Chicago and Eastern Illinois Railway Company, has ordered the company's divisional shops at Brazil, Ind., torn down, preparatory to moving them to Momence, Ill. A committee of thirty business men called upon Mr. Broughton and requested that the shops be allowed to remain. He answered that he was simply carrying out the instructions of the company, the city and county authorities having refused the company protection. He bitterly censured the sheriff for appearing on the company's property when appealed to for protection wearing the strikers' white ribbon, and when deputies were asked for, swearing in strikers, who put oil cans filled with emery on the locomotives. He said that when non-union men appeared on the streets, they were assaulted and driven out of the city. He censured the mayor for fining a non-union man for carrying a revolver, when the man's life was threatened, and said the boarding houses and eating houses had refused to feed the men, and the company thought it best to remove the shops.

AN ADJUSTABLE ELECTRIC LAMP HOLDER.

The illustration shows a simple and inexpensive bracket device by means of which an electric lamp may be conveniently placed where desired, by simply being moved into position by the hand. It is made by the Faries Manufacturing Co., of Decatur, Ill. The smaller figure shows the simplest form of the device, another style having two arms and a bracket with eyes

AN ADJUSTABLE ELECTRIC LAMP HOLDER.

to slip over a three-quarter inch iron pipe, the curved section working in the outer end of a horizontally swinging arm. The combined length of all these sections is five feet, so that the lamp can be placed in any part of the space within a circle of ten feet. There are no screws to be manipulated in making any of the adjustments, except when moving the bracket up or down the post.

Corea's Ancient Ironclad.

Ensign George C. Foulke, U. S. N., who spent several years in Corea in charge of the American Legation at Seoul, in a report to the Navy Department in 1883, wrote regarding Corean strength at sea:

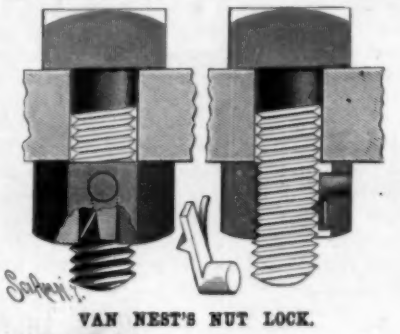
"The old navy consisted of junks, which were armed with grapnels, punching pikes, and small firearms. At present there are no vessels kept for war purposes at all. During the last war with the Japanese in 1619 an iron turtle-backed vessel was built by the Coreans and very successfully used against the Japanese wooden junks. From ports under the turtle-back grapnels were thrown on the Japanese junks, which were then capsized or sunk by having holes punched in them. This ironclad is still in existence at Yong Yong; it is one of the oldest, if not the oldest, ironclad in the world."

Army Bicycles.

The sum of 100,000 marks is included in the German army estimates for the present year for the supply of bicycles to the infantry. Two bicycles are assigned to each battalion. An instruction has been issued dealing with the bicycle service. Bicycles are to be used for communications between columns on the march and for communications between advanced guards. When troops are in quarters, bicyclists are to fulfill the functions of orderlies, especially where mounted orderlies are wanting. They will also relieve the cavalry from relay and intelligence duties. In great fortresses the whole of the duties now devolving upon cavalry as message bearers will be transferred to bicyclists.

AN IMPROVED NUT LOCK.

According to this improvement the nut may be turned freely to screw it up, but is prevented from unscrewing without stripping the threads from the screw bolt, making as strong a lock as the bolt will stand. It is a recently patented invention of Mr. Henry J. Van Nest, of Florence, Col. Two of the figures show different sectional views, while the small figure shows the key, which fits in a recess provided therefor within the nut. The key has a tongue-like piece running in the direction of the length of the bolt and having on one side a sectional portion of a screw thread fitting the screw thread on the bolt. The key is preferably made of steel, and is held in position, but so as to have a lateral swinging motion, by a lug entering a hole at right angles in the nut. Attached to and forming a

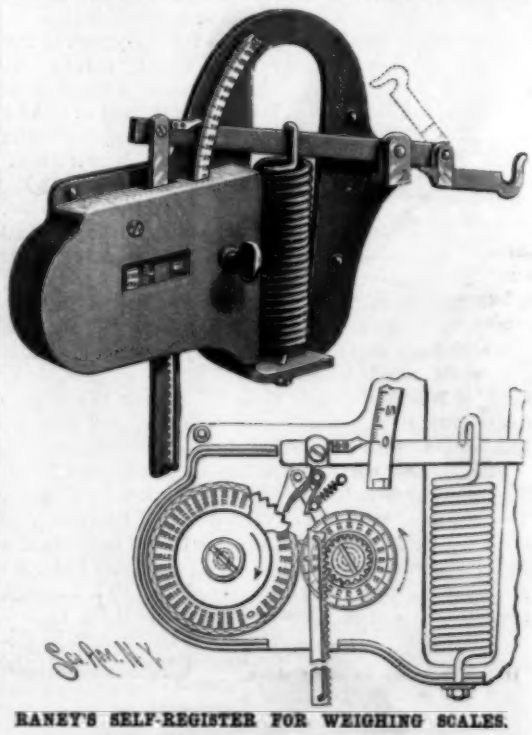


VAN NEST'S NUT LOCK.

side branch of the key is a spring, which causes the key to begin to act or start the friction of the key with the bolt.

RANEY'S SELF-REGISTER FOR WEIGHING SCALES.

The illustration represents an improved self-register, of simple and durable construction, which automatically registers the amounts weighed. It is shown as applied to a spring scale of any approved construction, although it may be readily adapted to lever and other scales, and one of the views represents an enlarged face view of the improvement with the casing cover removed. A patent for this invention has been granted to Mr. Oscar Raney, No. 101 Tyler Street, Topeka, Kansas. It is especially adapted for ice weighing and recording and all general weighing, at the same time not interfering with an account that is being kept, being readily attachable to one end of a refrigerator, or in some other convenient place about the premises. The end of the scale beam may be turned up out of the way, as indicated in dotted lines, and the beam is pressed on by a spring and has a pointer indicating on a scale the amount weighed. On the rear end of the beam is a downwardly extending rack, which engages a pinion turning loosely on the hub of an indicating wheel within the casing, the front face of this wheel being marked to indicate amounts weighed up to one hundred pounds, in such way that it may be seen through an opening in the casing. When it is desired not to register the loads weighed, the rack is thrown



RANEY'S SELF-REGISTER FOR WEIGHING SCALES.

out of mesh with the pinion by means of a key extending through the casing cover, whereby the registering mechanism may be at any time made inoperative, or again caused to register. In order to register more than one hundred pounds, the first registering wheel is connected with a second wheel, on which is a dial indicating hundreds and thousands, the pointer on the rack bar indicating on this dial as well as on the other, and so that the operator can at any time read the total amount registered from both dials through the opening in the cover casing.

The Photo-electric Action of Light.

The difficulties of working with ordinary polarized light in studying its photo-electric action disappear if the cathodes are formed of the alkaline metals, and advantage has recently been taken of this fact by Dr. J. Elster and H. Geitel. In the circuit of a voltaic battery of about 250 volts were placed a sensitive galvanometer, a commutator, and a sensitive cell of the liquid potassium-sodium alloy of the form described in Wiedemann's Annalen, vol. xlii., p. 564, so inserted that the negative pole wire leads to the surface of the alkali metal. The cell was coated with opaque varnish, with the exception of a small circle 15 m.m. in diameter, which was turned toward the source of light. The rays entering this aperture centrally and parallel struck the center of the metal surface under an angle of 65°, and between the source of light and the sensitive cell a lens was introduced for making the light parallel, as well as a polarizing arrangement. It was found with this apparatus that if the polarizing device is turned, while at the same time the strength of the current is measured in the galvanometer, two maxima and two minima are seen in the course of a single rotation. The ratio of maxima to minima is about 10:1. Other observations were made, which we can scarcely refer to here; but it will be remembered that, according to the results of Tronton, Klemencic and Righi, it must be taken for granted that in Hertz's rays of electrical force the plane of polarization is at right angles to the direction of the electrical displacement. So if the motion in the light rays is regarded as analogous, the result of the experiments made by Elster and Geitel would be thus expressed: The luminous electrical current attains its maximum when the electrical displacement in the luminous ray takes place in the plane of incidence, its minimum when they are at right angles thereto. In the former case the electrical vibrations contain a component normal to the cathode, but not in the second. We might be tempted to seek in these changes of potential normal to the cathode, and induced by the electrical rays, the force which impels the negative electricity to leave the cathode. Whether this suggestion is correct can perhaps be ascertained by further experiments on the dependence of the luminous electrical action on the angle of incidence of the polarized light, and their connection with the quantities of light reflected from and retained by the cathode. Further details may be found in a paper communicated by Elster and Geitel to the Phil. Mag., July issue.

Canaigre.

Canaigre is a tanning agent. It is a species of sour dock, and the dried root contains about 33⅓ per cent of tannic acid, or a higher average than the very best oak bark. It grows wild on most of the New Mexican plains or "mesas," and in that state yields from one ton to four tons to the acre, and in rare instances five tons. Under very simple cultivation and scanty irrigation the yield is at least ten tons per acre, and it will average ten tons to twenty tons. The United States experiment station attached to the Agricultural College at La Cruces has two fields planted now, one irrigated, the other dry. The habits and evolution of this plant from the wild to the cultivated state are being watched and recorded. At Deming, extracting works have been erected, and the product is being shipped to several tanneries in the United States and England.

A TRIUMPH in engineering is reported from the mountains of Peru, where a twin-screw steamer of 540 tons, 170 feet long and 30 feet wide, has been successfully launched on Lake Titicaca, the highest navigable waters in the world, more than 12,000 feet above the sea. This steamer, which belongs to the Peruvian government, is to be used for freight and passenger traffic, and was built on the Clyde, then taken apart in more than 1,000 pieces, and shipped to Mollendo by sea. It was then carried inland over the mountains to Puno by railway and put together on arrival at its destination by a Scotch engineer.

Fig. 1.—MAIN ENTRANCE OF THE LYONS EXPOSITION.

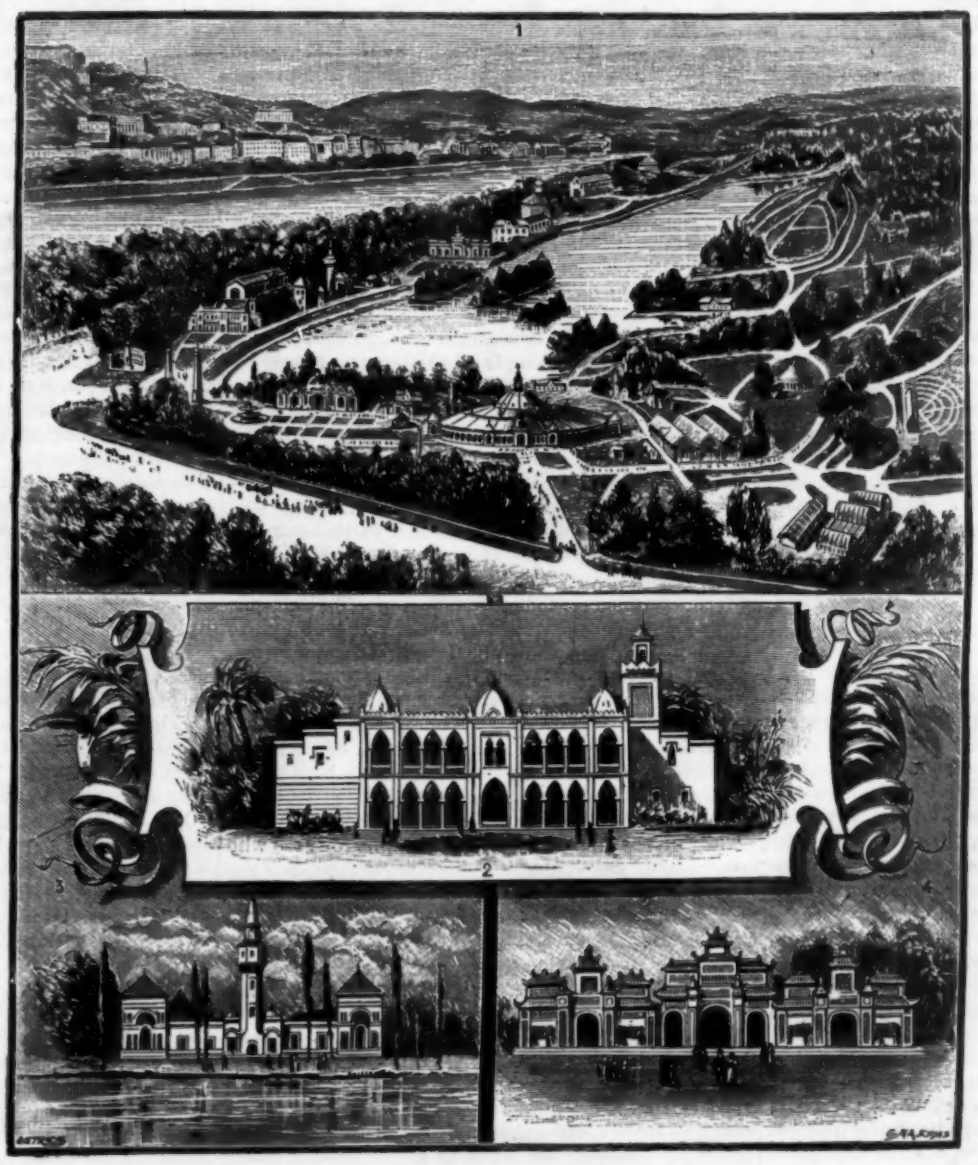


Fig. 3.—BIRD'S EYE VIEW OF THE LYONS EXPOSITION.

1. General View. 2. Palace of Algeria. 3. Palace of Tunis. 4. Palace of Indo-China.

THE LYONS UNIVERSAL EXPOSITION OF 1894.

The Lyons Universal Exposition opened its doors on the twenty-ninth of April, but it required several weeks longer to completely finish the work and get the exhibits in shape. Everything has been in readiness since the first of June, however, and the visitor can now admire the Exposition as a whole and in detail. The Exposition is organized in the magnificent Tete d'Or Park, which has an area of two hundred acres, and is certainly one of the most beautiful of its kind in France. There is nothing to be compared, as a panorama, with the beautiful lake of the park, with its islands and the large centenary trees that surround it. It is in the midst of greenswards and of clumps of trees of all species, whose leaves are green, purple or variegated, that the structures stand.

The principal palace of the Exposition is of a peculiar form and huge dimensions. When the visitor enters the dome of this structure, he is struck with wonder at the lightness and method of construction of the immense framework of metal, the external aspect of which is shown in Fig. 1.

The framework of this palace of iron and glass comprises two very distinct parts: the cupola and the annular part formed of two rows of pillars supporting balanced girders.

The central cupola covers a circular surface of 360 feet in diameter. It is not spherical, but has a parabolic form. It is composed of 16 half arches resting upon cast iron rollers 3¼ feet in diameter and assembled at their apex against a crown 16 feet in diameter and 6 feet in height. These arches have a pitch of 33 feet. They are formed of coffers from 4 to 6 feet in height, with solid frame pieces 2½ feet in width, and are connected at the sides by uprights and 3 inch U irons. The upper crown is 180 feet above the floor. The arches were calculated independently of one another and are, in reality, independent, each arch working for itself. They are not connected so as to form a rigid whole capable of supporting and distributing a given stress, and this is one of the curious points of this structure.

The arches are simply braced by iron purlins, the only object of which is to transmit to them the charge of the roof. It is to be remarked that they are charged only in the central part. The arches are calculated for supporting the weight of the iron in the purlins, rafters, etc., plus that of the covering (estimated at 30 pounds to the running foot) and the accidental supercharge.

The great dome of the Exposition covers a superficies of 491,800 square feet, and the diameter of its external framework is 700 feet. The main entrance of this magnificent structure is shown in Fig. 1. The Exposition as a whole is in a manner comprised within the immense hall of this palace, in which the show cases are so placed as to form circular galleries. There are many beautiful things to admire under the vast dome.

The exhibit of the Lyons silk mills is placed at the entrance, and offers to the eyes of the visitor the spectacle of the wonderful products of a great art. The general plan of the Exposition installed in Tete d'Or Park is represented in Fig. 2. The great dome

just described is seen at 1. The legend that accompanies the engraving gives an enumeration of the principal structures. The palaces of Algeria, Tunis, Annam and Indo-China are remarkable from an architectural standpoint, and the objects that they contain are no less interesting. In these palaces are displayed all the natural products of the soil of our colonies and specimens of the art and industry of their inhabitants. An inspection of them is highly instructive and useful.

Fig. 3 gives a panoramic view of the Tete d'Or Park, with all the structures that it now contains. Beneath the general view the artist has represented the palaces of Algeria, Tunis and Indo-China. Those palaces are constructed with much taste in the style of architecture prevailing in the countries whose products they contain. They rise gracefully in the vicinity of the lake, not far from the lawns, and are shaded by clumps of trees. They can be reached either by foot or by crossing the lake in a boat. It is a charming walk.

The palaces of Fine Arts, of Agriculture, of Liberal Arts, of the City of Lyons, and of the Liberal and Religious Arts and the Labor and Water and Forest expositions are no less curious to visit. The collections displayed therein, rich and well composed, gain by being isolated, each in one building, in order to be studied. In the garden of the Tete d'Or there are many amusing installations that offer agreeable diversions to the visitor.

We shall mention a very important exhibit of more than one hundred blacks of Senegal, the Soudan and Dahomey. Not far from there is the railway from Timbuctoo to Dahomey—a very original mechanical sport. The travelers are carried by a wooden elephant, camel and giraffe which glide over circular rails.

We may mention also the panorama of the Battle of Nuits, in which we see the entrance into Lyons of the "Mobiles" of Belfort. This masterly work is due to our celebrated artist, Mr. Poilpot. It has met with great success.

The great horticultural hothouse and botanical garden are yet to be mentioned. The Exposition of Horticulture is remarkable. It comprises over eight acres, divided into two gardens, one of them planted in the French and the other in mixed style.

We reserve for the end a mention of the captive balloon of Mr. Lachambre, one of our most competent balloon constructors.

The inauguration of the captive balloon of the Lyons Exposition, which makes ascensions every day, took place with complete success on the ninth of May, in the presence of the most influential people of the city. The balloon, which in dimensions recalls those exploited at the time of the Exposition of 1889 on the Champ de Mars and at the Trocadero, has a capacity of 113,000 cubic feet. It is made of extra quality Chinese silk, whose resistance at the cap exceeds 440 pounds to the square foot, while the other parts offer a resistance of from 200 to 300 pounds.

The fabric, which is covered with seven coats of varnish, is perfectly tight. The balloon is provided with a hermetical valve at the top covered with a hood to protect it from the rain. Another valve, placed at the lower part, opens automatically under the influence of the excess of the pressure of gas. The balloon is provided at the lower part with a compensating balloonet of a capacity of 17,500 cubic feet, which is provided with two automatic valves.

The netting, which is of Naples hemp, has no less than 24,000 meshes. The circular car, which is 8½ feet in diameter, is padded with silk and will comfortably accommodate 16 persons. The cable is 1,300 feet in length, and is capable of withstanding a stress of 20,000 pounds. It winds around a steam windlass, actuated by a 20 horse power two cylinder engine.

The balloon is inflated with pure hydrogen gas through a stationary apparatus of the Giffard system that produces 5,200 cubic feet per hour. For the first inflation 55,000 pounds of sulphuric acid and 22,000 pounds of iron filings were used.

The ascensions take place whenever the weather permits, from 9 o'clock in the morning till 11 at night. The aerostatic park is lighted at night by six arc lamps. A powerful projector sends its rays upon the balloon, which becomes a luminous globe. A photographic service is organized for photographing each voyage.—La Nature.

M. BOVET, of Pougues, asserts (Bullet. General de la Therapeutique) that he has succeeded in making milk digestible by adding to it legumine. This substance is a vegetable ferment, which, he says, acts upon the casein, turning it into a soluble albumenoid—a sort of lactated peptone. The legumine is also given independently as a food, in doses of fifty grammes or more a day. He reports a number of cases in which patients were able to take this combination of milk and legumine when all other foods were rejected.

The Cultivation of Children's Voices.

There seems to be a wide divergence of opinion regarding vocal training, many great singers contending that girls should not commence study at an age under fourteen years. I think this an erroneous premise when applied to all, for temperament, quality of voice, condition of health and climate have much to do with determining the proper age to begin vocal training. Take Albani as an instance of disproval of Nilsson's position. She began study at four, and whoever listened to a more charming Desdemona than she! The cultivation of a voice of good strength should be commenced as the child begins to sing, whether its age be four or fourteen. But no child with a promising voice should ever be compelled to jeopardize it by singing at inopportune times, or while suffering with a cold, to the utter loss of voice as a penalty.

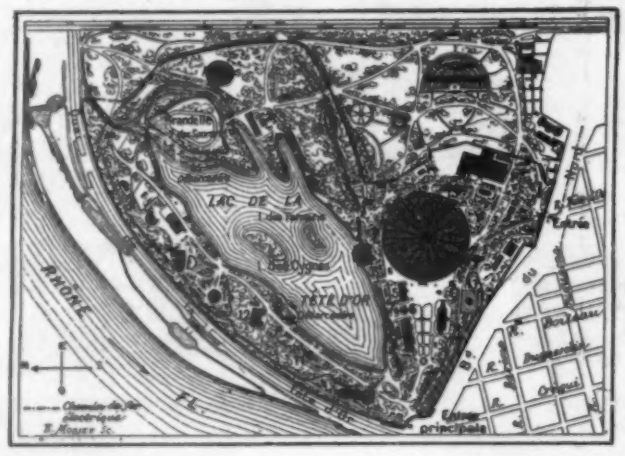


Fig. 2.—PLAN OF THE EXPOSITION.

1. Main Palace. 2. Palace of Fine Arts. 3. Agriculture, Railways, and Engineering. 4. Agricultural Annex. 5. Boiler House. 6. Press Building. 7. Post Offices and Telegraphs. 8. Lyons Palace of Liberal Arts. 9. Palace of Religious Arts. 10. Palace of Algeria. 11. Palace of Tunis. 12. Palace of Annam and Indo-China. 13. Labor Exhibition. 14. Water and Forests. 15. Panorama. 16. Hothouse. 17. Captive Balloon.

One of the first things a good teacher should do is to instill in the minds of pupils the great importance of taking care of the voice, regardless of the urging of those who care not for conditions to sing at inopportune times and when the physical condition warns to the contrary. Each pupil should be taught the limit of the voice, and made to understand that when she goes beyond the acquired compass the danger line has been reached.

While the finesse of teaching is all right enough, the common sense of teaching is all the better. If a child of nine has a good voice, why should tone cultivation be put off until it is fourteen? The breathing exercises, the physical culture, and the broadening of the chest, all tend to physical activity and the development of muscular strength which would otherwise remain unused. The position of the tongue, throat and mouth are no more difficult to attain in the younger than in the older pupils. The younger pupils can be easily taught the rules for speaking the words in song, and the staccatos, trills, crescendos and diminuendos come to children so easily that by the time they are eighteen they have accomplished their acquirement without any apparent effort, provided, of course, they have been under the care of a teacher who understands the delicacy of the human voice. To sing correctly and artistically is to sing without labored effort, and if this is true of adults, why should it not be true of children! The best way to prevent children from acquiring bad habits is to commence early training.

The criticisms made by my little pupils to those who imagine they are singing is quite often amusing. They realize that simply to sing a song by note does not signify that it is being sung musically. They detect the inartistic staccatos, the artificial tremolo, the lack of a foundation in sustained tones in the different registers and the lack of the feeling that makes sacred music sound as the author intended, devotionally.

The public school singing should be condemned. The teachers having so much to occupy their minds in teaching note reading, have but little time to devote to voice culture and to discriminating as to who should sing and who should not, and hence the voices of delicate little children are made to cope with the harsh tones of robust children. This causes little children to wonder why their throats become so tired, and parents to be surprised that at the end of the school term their voices have become so harsh and unmusical. In the school music class some children whose voices are low are compelled to sing with those who screech f, g and a, and many little voices whose tones are naturally high are compelled to sing alto, which I consider the most ruinous of all work, as they believe that chest tones which they force up high and harsh are proper, and when they hear the unmusical tones produced, they imagine that that is true alto, and when so imagining they make a most grievous mistake. The voice is precious. The possessor of a musical voice has a gift from God, and it should be trained properly.—Mary M. Shedd, in Music.

Sympathetic Inks.

Sympathetic or secret ink may be defined, says a writer in Chambers' Journal as "any liquid with which we may write invisible letters that will not appear until some particular agent is employed to give them color." There are several varieties, requiring different treatment, one merely needing exposure to the air; another, to fire; a third, the application of a certain vapor, and so on. Letters written with a solution of gold, silver, copper, tin or mercury dissolved in aquafortis, or, simpler still, of iron or lead in vinegar, with water added until the liquor does not stain a white paper, will remain invisible for two or three months if kept shut up in the dark; but, on exposure for some hours to the open air, will gradually acquire color, or will do so instantly on being held before the fire. Each of these solutions gives its own peculiar color to the writing: gold, a deep violet; silver, slate; lead and copper, brown; but all possess this common disadvantage—that in time they eat away the paper, leaving the letters in the form of perforations. There is a vast number of other solutions that become visible on exposure to heat, or on having a heated iron passed over them; the explanation being that the matter is readily burned to a sort of charcoal, simplest among which we may mention lemon juice or milk; but the one that produces the best results is made by dissolving a scruple of sal-ammoniac in two ounces of water.

Writing with rice water, to be rendered visible by the application of iodine, was practiced successfully in the correspondence with Jelalabad in the first Afghan war. The letter was concealed in a quill. On opening it, a small paper was unfolded, on which appeared the single word "Iodine." The magic liquid was applied, and therewith appeared an important dispatch from Sir Robert Sale. In the course of a trial in France last year, a letter was read from a man named Turpin, a chemist, under sentence of five years' imprisonment as a spy, giving directions to a friend with a view to establishing a secret correspondence with him while in prison. This led to an official inquiry on the subject by the French authorities, and some strange revelations were obtained from some of the convicts. It appears that when information has to be conveyed to a prisoner, a formal letter, containing apparently nothing but a few trivial facts of a personal nature, is forwarded to the prison. This is read by the governor, who stamps it, and allows it to be handed to the man to whom it is addressed. The latter, however, is aware that there is another letter to be read within the lines, this being written in milk, and being easily decipherable on being rubbed over with a dirty finger.

Perhaps the most dangerous of its kind is one that consists of an aqueous solution of iodide of starch. In four weeks, characters written with it disappear, preventing all use or abuse of letters, and doing away with all documentary evidence of any kind in the hands of the recipient. But a recent discovery by Professor Braylants, of the University of Louvain, surpasses all, inasmuch as no ink at all is required in order to convey a secret message. He lays several sheets of note paper on each other, and writes on the uppermost with a pencil; then selects one of the under sheets on which no marks of the writing are visible. On exposing this sheet to the vapor of iodine for a few minutes, it turns yellowish and the writing appears of a violet-brown color. On further moistening the paper, it turns blue, and the letters show in violet lines. The explanation is that note paper contains starch, which under pressure, becomes hydramide, and turns blue in the iodine fumes. It is best to write on a hard desk, say a pane of glass. Sulphurous acid gas can make the writing disappear again, and it can be revived a second time.

Voting Laws.

Two general city elections have been held in Kansas City since a charter was adopted which contained a provision imposing a poll tax of $2.50 on every male citizen over twenty-one years old, the same to be remitted if he voted at the general election. No attention was paid to the provision, and nearly $100,000 stands on the books against citizens who failed to vote. In a test case on the constitutionality of the law, Judge Gibson lately decided it valid, and that every tax could be collected with interest and costs. In Mississippi a contrary law prevails. No person is allowed to vote unless he has first paid a tax. The object is to prevent negroes from voting, and the law is a great success in that respect.

29·368 knots, or almost 34 miles per hour, is the rate of speed made by the newest British torpedo boat, the Daring. This boat is 185 feet long and 19 feet beam.

THE EVOLUTION OF HANDICRAFT.

The inventor has labored in all ages, but unfortunately he has not always left an enduring trace of his handiwork. In some of our museums attempts have been made to trace the history of tools from the time when the prehistoric denizens of caves waged war against the monsters of the glacial period; but such collections are almost invariably incomplete. Still, with the scant material that remains to us, we are enabled to form an excellent idea of the manners and customs of peoples whose race has entirely vanished.

One of the oldest implements, of which we have any record, is the stone celt, which is found in nearly all parts of the world where prehistoric remains have been discovered. The celt, Fig. 1, is an ax with a chisel edge, usually used without a handle. There are many varieties of celts, from the rough neolithic celt, simply picked into shape, to magnificent examples beautifully shaped and highly polished, of a later time. Fig. 2 shows a mould for the casting of bronze implements. This remarkable mould was found in the third or burnt city of Troy by Dr. Schliemann, so that its date is problematical. The mould, which was made of mica-schist, resembles the moulding flask of to-day as regards economy of space. The metal was simply poured into the furrows and the mould was then covered with a flat stone to cool. The bronze hatchet, which we illustrate in Fig. 3, was in use among many of the peoples of antiquity, and is particularly interesting on account of the ear which was used to hold the head firmly on a projection of the handle, at right angles to the body of the handle, by means of cord. Fig. 4 is an Assyrian bronze knife. The design is copied from the old flint flake knives.

The transition from Assyria to Egypt is gradual, but once on Egyptian soil, we are in the presence of a hoary civilization which has been the wonder and the admiration of the world. In Figs. 5 and 6 we have representations of a cabinet maker and one of his tools. The grotesque little figure engaged in chair making is taken directly from a tomb painting, while an example of the bow drill is preserved in the British Museum. This handy tool was much used by the Egyptians and modern invention has not as yet superseded it for certain classes of work. In agricultural implements the advance is not as well marked, as shown by the hoe illustrated in Fig. 7, where the blades and handles are simply inserted the one into the other and bound together with a twisted rope. The fittings of the Egyptian houses were very remarkable. The doors consisted of either one or two valves, and turned on pins of bronze as illustrated in Fig. 10, which shows the lower pin of the door.

The Romans brought the same inventiveness and perfection of handicraft to bear upon the fabrication of the smaller objects of manufacture that they exhibited in their vast engineering works. The water works of the Romans are deservedly celebrated, and the system by which the water was conducted through the aqueduct into the fountains of the private houses showed the highest knowledge of hydraulic engineering, and a familiarity with plumbing that would reflect credit upon a metropolitan sanitary plumber. From the reservoirs the water was conducted to the houses by means of clay or lead pipes. Bronze pipes were used where the hydraulic pressure might have burst leaden pipes. The lead pipe was usually made by folding up a sheet of cast lead and soldering it. Fig. 13 shows a main, dug up in Rome, with two service branch pipes inscribed with the name of Severus (192 A. D.) The inscriptions on the pipes are a very valuable source of information, as various facts are recorded on them, as the name of the emperor, the owner of the house, the plumber, the capacity of the tubes, the date of the pipe, etc. Fig. 9 shows a bronze service cock beautifully finished.

In the matter of tools and household utensils the same perfection of finish obtains as in the plane, Fig. 11, the steelyard, Fig. 12, and the highly ornate brazier shown in Fig. 14, all in the museum of Naples, and as they came from Pompeii, of course date back to 79 A. D. The steelyard is proved for the year 77 A. D. by the regularly appointed sealer. The brazier is really an elegant piece of art metal work, and something modeled upon this pattern might well be introduced into those countries where chimneys and fireplaces are not in general use, instead of the cheerless charcoal brazier of the ordinary pattern. This brazier is 14 inches square, exclusive of the semicircular projection, which is made hollow to receive water. On the top of this water back are three eagles, intended probably to support some cooking utensil. Water is drawn off from the ornamental mask in the round tower, which has a movable lid.

The hydraulic organ shown in Fig. 15 is credited to Ctesibus, of Alexandria, 150 B. C., and betrays Greek influence. The windmill actuated the piston which took the place of the bellows. The keys simply uncovered the bottom of the tubes and permitted the air to reach the pipes.

From this point we will jump to the middle ages and see what our more immediate forefathers were engaged in, and incidentally examine a couple of objects which show the tardy development of inventiveness, as in the modern plow of Castile, Fig. 8, and the African pole lathe, Fig. 16, still in use among the Kabyles of Africa. A reciprocating motion is imparted to the spindle by the cord; when the bowl or other article is rotated toward the operator the cutting tool is applied; the tool is then removed, the foot is raised and the elasticity of the sapling rotates the spindle in the opposite direction, and the operation is repeated until the object is turned. Lathes of this kind are in use in various parts of the world, and in our own country they were a feature of the backwoods until a few years ago, and even now some isolated examples might be found in some of the rural districts.

In the Catalan forge or furnace we have some of the methods of modern metallurgy foreshadowed. The process is now practically obsolete, though forges of this type are still to be seen in the Pyrenees, where the ore is rich and fuel plenty. The blast for reducing the ore is produced by a stream of water, which carries the air down with it into a chamber where the air and water separate, the water running out of the cistern while the air rushes through the sheet copper tweer on the metal and fuel in the bottom of the furnace, which is formed of refractory stone. The fall of water is usually twenty-five feet, and no chimney is needed. The blast is continuous, but the air is saturated with moisture. This arrangement is called a trompe.

Fig. 18 shows the development in apparatus for putting out fires, which is only a modification of the "squirt" or syringe which was used in the times of the Romans. This interesting apparatus dates from 1568, and is taken from Besson's "Theater." The water was poured into the funnel by means of pails. When the body of the syringe was full the valve was closed, cutting off the funnel; the crank was then turned and a barrel of water was projected through the nozzle with considerable force. The time required to fill the body of the syringe was not excessive, as the water could be poured in while the piston was being run back. The method of adjustment was extremely crude, the half circle with holes for bolts being used. When a lateral change was necessary, the whole apparatus had to be moved. Although the invention now appears to us to be a very poor affair, the efficiency of such a fire apparatus must have been great at a time when nearly all buildings were semi-fireproof. Fig. 19 shows a medieval "ladye" at her loom, and is from Erasmus' book, the "Praise of Folly." The arrangement could not well be more primitive. Figs. 20 and 21 show artisans plying the trades of carpentry and lantern making. The period of the lantern maker is 1568, while the carpenter group is fifty years older. This illustration shows the tools in ordinary use in carpenter work at that period.

Figs. 22, 23, 24, illustrating the allied trades in 1564, are reproduced in fac-simile from a rare German work, usually called Jost Amman's Book of Trades, but the correct title is Hans Sachs' "Correct Description of All Arts, Ranks and Trades." Hans Sachs was the famous cobbler-poet immortalized by Wagner in his opera, "Der Meistersinger von Nurnberg." We owe a great deal of our information in regard to the arts of the middle ages to the quaint old cuts in this charming work. Paper making is of course the first step to book making, and in Fig. 22 we are introduced into a paper mill of considerable size, to judge by the water wheels which set in motion primitive pulp beaters. The paper maker is just dipping out the pulp to form into sheets; the powerful screw press in the background finished the paper and corresponds to our calendering rolls. In Fig. 23 we have an interior view of a printing office at the same period. In the alcove near the window, where the light was good, two compositors are shown working from the cases.

In the foreground is seen a powerful screw press; one of the men is inking the form, another taking off the printed page. In the Plantin-Moretus Museum, in Antwerp, we have a veritable printer's paradise, for the old presses are left in the same position that they occupied two hundred years ago. In Fig. 24 we have the bookbindery in which the books, printed in the printing office shown in the preceding cut, are bound. In the foreground is the forwarder, with leather apron, trimming the edges of the book with a plow. The remainder of the tools are disposed in various parts of the room; the rolls particularly have not changed, except as regards the pattern engraved on them, and even now the best finishing tools are patterned after the old. Bookbinding is one of the few arts which has made little, if any, progress in the last two hundred and fifty years. The sewing frame in the rear is almost the same as may be found in use to-day.

Whatever elation we may have in looking back at the primitive condition of the arts or manufactures of past ages, the pride that we feel in the great wisdom and achievements of our own time should be tempered, perhaps, by the remembrance of the large number of so-called "lost arts." The fire engine and the loom and organ seem to us to be distinctly modern, but here we find that they have been known for centuries. In spite of all the knowledge of modern science and with the benefit of the wisdom of past ages to aid us, how many are the lost arts that modern invention has been unable to rehabilitate.

Kamela.

Kamela, or kamala, as it is written in the British Pharmacopœia, is at one and the same time a drug and a dye, and in the latter capacity it has never had practical justice done to its merits, although many writers have praised the shade and durability of the colors it gives on silk. The dyestuff is a powder, lying as a bloom on the outside of the fruits of the Mallotus Philippinensis, known also as the Rottlera tinctoria. This is a small evergreen tree, found throughout tropical India, and known to the Anglo-Indian as the monkey-faced tree. It is said also that the roots of the plant yield a red dye, but this seems to be rarely used nowadays. It is thought that the introduction of annatto displaced kamela, for, although inferior to kamela in many respects, annatto is a simpler and cheaper dye. Still there is no doubt that kamela has been neglected in every way. A demand for it would insure a constant supply, and if hitherto the price has been high, it is because of the improvident methods of gathering the crop practiced by the natives, and also because outside the districts in which it is grown there is an inadequate inquiry for it. The tree is wild, and apparently nowhere cultivated; the powder is obtainable in any local bazar, and within easy reach of the chief seaports. If a demand were to arise, the supply might be almost indefinitely increased, without, for many years to come, necessitating cultivation. It is quite customary to find, in sub-tropical forests, miles of country with here and there trees each bearing a mass of over-ripe powdery capsules, the kamela from which is simply being allowed to run to waste.

The powder seems to vary greatly in price in the various districts of India. Lisboa remarks: "If the berries be plucked too early, this dust is mixed with another sort, of a greenish tint, which destroys the value of the article, and, if not plucked at the right time, the dust will all disappear, being blown away by the wind, leaving the berries of a greenish-brown color and of no value. The article kamela finds a ready market, and is now worth 1s. 6d. a pound."

Kamela powder was first examined by the late Professor Anderson, of Glasgow University, and subsequently by E. G. Leube, Jr. The opinions originally published by these chemists have been reproduced in all subsequent medical works which have appeared in Europe, America, and India, without apparently any additional information being brought to light. The powder is said to be aromatic, is but slowly wetted by water, and yields but little color even to boiling water, coloring it pale yellow. In the presence of alkaline carbonates and caustic alkalies, especially the latter, it forms deep red solutions. The extract prepared with soda imparts to silk a fine and durable fiery orange color without further addition or the use of mordants; with cotton, on the other hand, it does not produce a good color. The natural dyestuff contains 3·49 per cent water, 78·19 resinous coloring matters, 7·34 albuminous substances, 7·14 cellulose, and 3·84 ash, besides small quantities of volatile oil and a volatile coloring matter. The liquid distilled from the alcoholic extract has a yellow color and the odor of the original substance. The concentrated ethereal extract of the coloring matter deposits a yellow crystalline substance called rottlerin. The extract, prepared with boiling alcohol, deposits, on cooling, non-crystalline flecks of a substance having the composition of $C_{35}H_{34}O_4$. It may be obtained nearly colorless, by repeated solution and separation; it is sparingly soluble in ether and in cold alcohol, insoluble in water; not precipitated by lead or silver salts. The alcoholic solution separated from these flecks leaves a dark red resin, $C_{31}H_{32}O_7$, soluble in all proportions in alcohol and ether, insoluble in water, melting at 100°, and forming with acetate of lead a deep orange colored precipitate of variable composition.

The brief account of the chemistry of this substance given above, which we derive from the Dyer and Calico Printer, expresses the rationale of its use as a dye. The ripe fruits are collected by the people, placed in a cloth or sack, and beaten until the glandular pubescence is removed from the exterior of the fruits. The powder thus obtained is then sifted to free it from the fruits and broken pieces, and in this condition it is ready for the market. McCann says: "The powder is only very sparingly soluble in either hot or cold water, but is completely dissolved in alkaline liquids, forming a dark red solution. The resinous yellow coloring matter may be separated from this red solution either by neutralizing with an acid or else by mere exposure to the air. In Bengal the red powder is dissolved by the addition of a solution of various alkaline ashes obtained by burning plants, and the development of the yellow coloring principle is in no case brought about by the addition of acids, but merely by allowing the cloth steeped in the red liquid to dry by exposure to the air. It is said not to require a mordant, but frequently alum is added for that purpose. The color is sometimes heightened by the addition of turmeric."

DANIEL GARRISON BRINTON.

BY MARCUS BENJAMIN, PH.D.

The American Association for the Advancement of Science returns to this vicinity after an absence of seven years. It will hold its forty-third annual meeting in Brooklyn, having held its meeting last year in Madison, Wis. It comes from the West to the East, and it goes from the North to the South, leaving behind an influence resulting in a higher appreciation of scientific work and of scientific workers. As it comes and goes, casting its favors impartially upon different sections of the country, so, too, the Association bestows its honors upon representatives of different branches of science. This year a distinguished ethnologist is the accepted presiding officer.

Daniel Garrison Brinton was born in Thornbury, Chester County, Pa. He comes of English lineage, and his ancestor, William Brinton, of Shropshire, became a member of the Society of Friends and followed William Penn to this country in 1684. Of his boyhood days, Dr. Charles C. Abbott has told of his early fondness for antiquarian research, and how "many a day was passed in collecting the broken arrow points, the stone axes, and the fragments of pottery which marked the presence of this older and mysterious race." The same writer gives credit to Sabine's translation of Humboldt's Cosmos as having had a "formative influence upon his youthful tastes." He was graduated at Yale in 1858, and among his classmates were Prof. J. Millard Gibbs, whose researches in mathematical physics have gained for him much reputation and high honors, and Hon. William T. Harris, the present Commissioner of Public Education. Then, choosing medicine as his profession, he received his degree at the Jefferson Medical College in 1860. After a year abroad, chiefly in Paris and Heidelberg, he returned to the United States when the civil war was in progress, and in August, 1862, entered the volunteer army as acting assistant surgeon. He received the promotion of surgeon in February, 1863, and as surgeon-in-chief of the second division of the eleventh corps of the Army of the Potomac took part in the battles of Chancellorsville and Gettysburg. A sunstroke at the last named battle prevented further service on the field, and he became superintendent of hospitals in Quincy and Springfield, Ill., until the close of the war, when he was discharged with the brevet of lieutenant colonel.

He then settled in Philadelphia and became editor of the Medical and Surgical Reporter, which place he held from 1867 till 1887, also at the same time editing the quarterly Compendium of Medical Sciences. In the medical controversies of his time he always took the position that medical science should be based on the results of chemical observation rather than on physiological experiments. With this brief reference to his work in medicine, we pass to the consideration of his ethnological researches.

While still a student at college he spent a winter in Florida, where he gathered material resulting in the publication of "The Floridian Peninsula: its Literary History, Indian Tribes and Antiquities" (Philadelphia, 1859), which, although only a small duodecimo volume of two hundred pages, remains to-day our best resume of the archæology of that wonderful peninsula. On his return to Philadelphia after the war he renewed his antiquarian studies, and published, in 1868, "The Myths of the New World: a Treatise on the Symbolism and Mythology of the Red Race of America," of which a second edition has been called for. This work led naturally to his formation of a library on the subjects of his investigations. In order to place within the reach of students authentic materials for the study of the languages and culture of the native race of America, he began the publication of a series of works composed in the native languages by the natives themselves, thus presenting these tongues in their real forms. This series, called "Library of Aboriginal American Literature," he published himself, and has thus far included the following eight volumes: 1, The Chronicles of the Mayas (1882); 2, The Iroquois Book of Rites; 3, The Comedy Ballet of Gueguence (1883); 4, A Migration Legend of the Creeks; 5, The Lenape and their Legends (1885); 6, The Annals of the Cakchiquels (1885); 7, Ancient Nahuatl Poetry (1887); and 8, Sacred Chants of the Ancient Mexicans (1890); all of which have been edited by himself, except the second and the fourth volumes. While from some sources these works have met with adverse criticism, still they have, for the most part, received the highest commendation from specialists, and Dr. Brinton was awarded in 1886 the prize medal of the Societe Americaine de France, being the only instance in which it was decreed to a native of the United States. His work also received recognition at home, and in 1884 he was appointed professor of ethnology and archæology at the Academy of Natural Sciences in Philadelphia, also, two years later, he was given the chair of American Linguistics and Archæology in the University of Pennsylvania. At both of these institutions he has since regularly given a course of lectures during the winter months. These are largely attended, and as a lecturer Dr. Brinton very successfully exercises the faculty of conciseness, yet never at the expense of lucidity.

In American linguistics he has made many valuable contributions. He has published articles and studies on the Arawack, Aztec, Cakchiquel, Choctaw, Delaware, Maya, Muskogee, Natchez, Quiche and other languages. His special works on this subject include "A Grammar of the Choctaw Language," "A Grammar of the Cakchiquel Language," "The Philosophic Grammar of American Languages," "Studies in South American Languages," and "A Lenape-English Dictionary," which is based on a manuscript of the last century that was preserved in the old Moravian church in Bethlehem. It was published in 1889 by the Pennsylvania Historical Society.

The Archæological Association of the University of Pennsylvania was organized in 1889, and in natural consequence of his relation to that university Dr. Brinton at once became prominently identified with its management. The museum developed under its auspices is of special value to scientists, because most of its specimens were obtained from intelligently conducted explorations, rather than from the purchase of collections. In consequence, every available fact with reference to the history of its specimens is known. For this wise provision credit is due to Dr. Brinton's foresight and sagacity.

DR. DANIEL G. BRINTON.
President of the American Association for the Advancement of Science.

It is not possible to follow in detail the work of so broad a scientist or so prolific an author as the subject of this sketch, and therefore we cannot even mention the many, very many contributions that he has made in the way of special studies, but space must be made for the titles of several of his larger works. "The Religious Sentiment: a Contribution to the Science of Religion" (1876); "American Hero-Myths: a Study in the Native Religions of the Western Continent" (1882); "Essays of an Americanist" (1890); and "The Pursuit of Happiness" (1892), have firmly established his place among American men of letters.

By a seemingly strange and yet not uncommon peculiarity of scholars and students, Dr. Brinton finds pleasure and relaxation in a matter remote from the subjects of his more earnest labors. We refer to his great fondness for poetry. He is active in the Browning Society of Philadelphia and has been one of its vice-presidents. Likewise he was a friend of Walt Whitman, and is president of the recently organized "Walt Whitman Fellowship," devoted to "the elucidation of the poet's philosophy of life and the underlying principles of his work." He has published frequent papers on the writings of both poets.

In addition to the degrees that he received in course, Jefferson Medical College conferred on him the degree of LL.D. in 1891, and the University of Pennsylvania that of D.Sc. in 1893. Besides his membership in the American Philosophical Society and the American Antiquarian Society, he has been president of the American Folk-Lore Society and of the Numismatic and Antiquarian Society of Philadelphia. He was a commissioner to the Columbian Historical Exposition in Madrid in 1892, and besides being a member of the International Jury of Awards at the World's Fair in Chicago in 1893, was president of the International Anthropological Congress held there at that time. Of foreign societies, he is a member of the Anthropological Societies of Berlin, Rome, and Vienna, and of the Royal Ethnographical Societies of Paris and Florence, the Royal Society of Antiquaries, Copenhagen, and the Royal Academy of History, Madrid.

Of his relation to the American Association, a word is necessary. He joined that organization in 1884, when it met in Philadelphia, and a year later was made a fellow. He presided over the section on anthropology in New York in 1887, and then delivered an address entitled "A Review of the Data for the Study of the Prehistoric Chronology of America." From that time until the last meeting his attendance at the annual gathering of the Association has been regular and accompanied usually by one or more of his valuable papers. It was therefore but natural when the choice of a president came up at the meeting last year that his name should have been promptly recognized as a representative one.

To the sketch by his associate and friend, Dr. Charles C. Abbott, we are indebted for many of the facts here given. That writer has well said: "American science and American letters may be proud of such a worker, for his position, both as a scientist and a litterateur, is no uncertain one." Such an opinion from one so competent to express it is not mere praise of the scientist who has been chosen to preside over the Brooklyn meeting of the Association for the Advancement of Science.

The Sturgeon Industry.

There promises to be a big run of sturgeon this year, and that means a great deal to the dealer in caviare. The caviare sandwich has now become so popular in the United States that the supply is scarcely equal to the demand. As is known, the black, fishy paste that is now the fad between pieces of bread at late suppers is made of sturgeon eggs. In order to add to the fashion, nearly all the little kegs of caviare have borne Russian or German labels, but they all come from this side of the Atlantic, and most of them originated in Delaware Bay. Bayside is the main shipping point. That it pays the fishermen to work hard at the business will be seen when it is stated that sturgeon meat is worth from four cents to six cents a pound, and a keg of caviare, containing about 125 pounds, sells readily for $30. Other States have sturgeon fishermen, but in point of numbers employed and capital invested New Jersey leads and represents over one-half of them. The capital invested in the sturgeon and caviare industry in the United States is slightly more than $1,000,000, and the people employed, in round numbers, about 4,000. There are twelve firms in the lake regions of the West, where the fishing is carried on with pound nets and seine nets.

Outside of New Jersey the largest amount of capital is invested by these lake fishermen, being about $335,000. There are only half a dozen firms in New York State engaged in the business. Sturgeon are caught entirely by nets, and the fish average from 150 to 300 pounds. The roe sturgeon brings the fisherman from $7 to $8, while a buck is only valued at from $1 to $1.50. The Jersey fleet has 146 boats. Nearly every part of the fish is used. The offal is gathered up and made into fertilizers. Sturgeon oil is extracted from other parts and used by harness makers, but the principal industry is the manufacture of caviare. A good sized sturgeon will give from three to four buckets of roe. The eggs are separated by running them through a coarse sieve several times and then salted down by a composition of salts, which is made in Germany. It takes from three to four sturgeon to make a keg of caviare. Twenty years ago the sturgeon was so plentiful that the fishermen spent their leisure time killing them, because of the destruction of smaller fish and the havoc they caused among the shad nets. Now the fisherman's wail is that the sturgeon is becoming so scarce that the industry is threatened.—Boston Evening Transcript.

Inventor of the Famous Jacquard Loom.

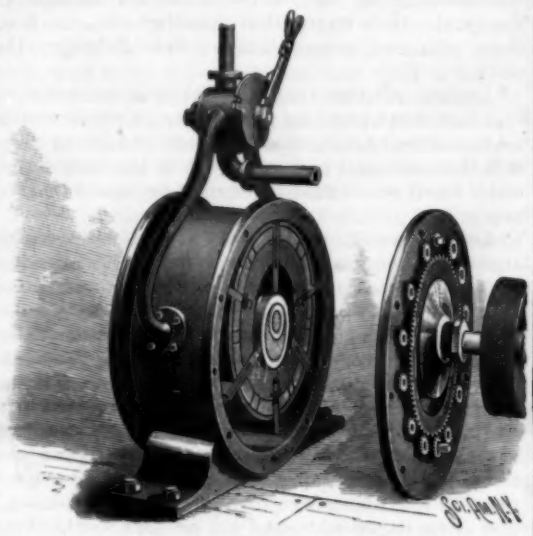
"After seven years—a long time to patiently develop an idea—Jacquard had produced a loom which would decrease the number of workmen at each machine by one person. . . . In gratitude for this discovery he went to the image of the Virgin, which stood on a high hill, and for nine days ascended daily the steps of the sacred place. Then he returned to his work, and seating himself before a Vaucanson loom, which contained the germ of his own, he consecrated himself anew to the perfecting of his invention. . . . It remained for Jacquard to make the Vaucanson loom of the utmost practical use to Lyons and to the world. After a time he was not only able to dispense with one workman at each loom, but he made machinery do the work of three men and two women at each frame. . . . When brought before Bonaparte and Carnot, the Minister of the Interior, the latter asked, 'Is it you, then, who pretend to do a thing which is impossible for man—to make a knot upon a tight thread?' Jacquard answered the brusque inquiry by setting up a machine, and letting the incredulous minister see for himself. The Emperor made Jacquard welcome to the Conservatoire des Arts et Metiers, where he could study books and machines to his heart's content, and gave him a pension. . . . Soon, however, the tide of praise turned. Whole families found themselves forced into the street, for lack of work, as the looms were doing what their hands had done. Bands of unemployed men were shouting, 'Behold the traitor!' . . . The authorities seemed unable to quell the storm, and by their orders the new loom was broken in pieces on the public square. 'The iron,' says Jacquard, 'was sold as old iron; the wood, for fuel.' . . . Soon Switzerland, Germany, Italy and America were using the Jacquard looms, largely increasing the manufacture and sale of silks, and therefore the number of laborers. The poor men of Lyons awoke to the sad fact that by breaking up Jacquard's machines they had put the work of silk weaving into other hands all over the world; and idleness was proving their ruin. . . . The inventor refused to take out a patent for himself, nor would he accept any offers made him by foreigners, because he thought all his services belonged to France. . . . The struggling, self-sacrificing man, who might have been immensely rich as well as famous, was an untold blessing to labor and to the world."—Extracts from the Life of Jacquard, by Sarah K. Bolton.

THE TOXOPHILITE SOCIETY.

The elegant and once fashionable art of shooting with the long bow has been properly called "archery," and everybody knows the meaning of that word. "Toxophilite," however, derived from the Greek, cannot signify anything but the love of the bow; perhaps many people would naturally think it might be the designation of some chemical compound. But if they were admitted to the beautiful grounds of a highly select society, in the inner circle of Regent's Park, they would soon be enlightened, and would learn to admire a graceful kind of skill, not, indeed, so robust an exercise as lawn tennis, yet sufficiently amusing for leisure hours of a summer day.—Illustrated London News.

AN IMPROVED MOTOR OR PUMP.

A motor designed to be worked advantageously by either steam or water, and which may also be readily converted into a powerful pump, is shown in the accompanying illustration, and has been patented by



BROWN'S MOTOR OR PUMP.

Mr. C. E. Brown, of Stayton, Oregon. It has a single cylinder in which turns a shaft from which power is taken, or to which power is applied when used as a pump, the shaft turning in a stuffing box in one of the cylinder heads, and the inner end of the shaft being mounted in a socket stuffing box in the other head. The shaft is placed above the center of the cylinder, so that a chamber for steam or water is formed around the lower portion of the piston, the latter being provided with radial slots in which are sliding supports carrying wings forced outward by springs, and forming abutments against which the steam or water strikes. In recesses in the piston ends are rings, which, as the piston revolves, force the wings inward and outward, and there are also provided short spring-pressed wings, extending only partially across the steam or water chamber, to form an increased area for the steam and water to act against, and also to prevent back pressure. In the ends of the piston, and near its outer periphery, are packing rings made up of segmental sections, pressed outward by springs, a wedge-shaped spring-pressed block between each pair of sections spreading the sections endwise and keeping the rings tight.

The cylinder head nearest the pulley has means of adjustment to take up wear and leakage, having an inwardly projecting portion provided with a split calking ring expanded by a screw which projects through the head, thus making a tight joint. The ring is pushed inward by screws mounted circumferentially on the head, pinions on the outer ends of the screws meshing with a cogwheel engaged by a pinion on which is a stud to receive a crank, by turning which the several pinions are simultaneously revolved to force inwardly all portions of the inner head and calking ring. From a valve casing at the top a pipe leads to each side of the cylinder, either pipe being used as a supply or exhaust pipe, according to the direction in which the piston is to be rotated, and these pipes connect with grooves or ports in the inner sides of the cylinder. A self-governor is also provided for the device when used as a motor, consisting of check valves which open under pressure from within the cylinder, and when the engine is running at high speed the centrifugal force throws out the blades of the wings against the tension of springs, in one form of the improvement, to shut off the supply of steam from the space where the most effective pressure would be exerted.

Meat Eating and Temper.

Mrs. Ernest Hart, who accompanied her husband in his recent trip around the world, appears to come to the conclusion that meat eating is bad for the temper. In the Hospital she says that in no country is home rendered so unhappy and life made so miserable by the ill-temper of those who are obliged to live together as in England. If we compare domestic life and manners in England with those of other countries where meat does not form such an integral article of diet, a notable improvement will be remarked. In less meat-eating France, urbanity is the rule of the home; in fish and rice-eating Japan, harsh words are unknown, and an exquisite politeness to one another prevails even among the children who play together in the streets. In Japan I never heard rude, angry words spoken by any but Englishmen. I am strongly of opinion that the ill-temper of the English is caused in a great measure by a too abundant meat dietary, combined with a sedentary life. The half-oxidized products of albumen circulating in the blood produce both mental and moral disturbances. The healthful thing to do is to lead an active and unselfish life, on a moderate diet, sufficient to maintain strength and not increase weight.

SOUTH AMERICAN ants have been known to construct a tunnel three miles in length, a labor for them proportionate to that which would be required for men to tunnel under the Atlantic from New York to London.

MEETING OF THE TOXOPHILITE SOCIETY.

A Whaling Adventure.

A most disastrous accident occurred to the whaleship Essex, belonging to Nantucket, and commanded by Captain Ronald Pollard. While cruising in the South Pacific the ship discovered a school of large sperm whales, and all the boats were at once lowered to assail them. The mate and captain succeeded in fastening at about the same time. The former lanced his victim, and while engaged in tying his fins together preparatory to securing him alongside the ship, which was about a mile away, but bearing down in response to the mate's signal, the captain was placed in danger by the whale which he had struck making for his boat after rising. Great dexterity on the part of the rowers and steerer swept the boat out of the path of the infuriated fish—which kept on in a direct line, dragging the whaleboat after him with such velocity that the parted waters stood a foot above the gunwale, but were prevented from falling into the boat owing to the great speed maintained. It was quickly seen that the ship was in the path of the fleeing whale, and the captain hailoed to the men on board to alter the course of the vessel, and it was evident that the danger was appreciated by the helmsman of the Essex, for the head of the ship was observed to fall off; but ere she could be swept out of the track the whale struck her with such frightful force that the bows were crushed in, and all three masts were carried away. The vessel immediately filled with water but remained floating, with her upper deck even with the water, owing to the number of empty barrels in her 'tween decks.

Fortunately quite a quantity of provisions were in the galley when the accident took place, and a barrel of salt pork and one of beef were recovered from the hold a day or two later. For over a week the crew lived on the deck of the ship, hoping to sight a sail; but none appearing, and realizing that they were in an unfrequented part of the Pacific, they took to the boats, with the idea of reaching Valparaiso, the nearest port. A few days following they sighted Ducie's Island, an almost barren land situated in the latitude of 24° 40' south and the longitude of 124° 48' west. In a cave close to the beach the men found eight skeletons, and a board in which had been cut with a sailor's knife the words, "Ship Elizabeth of London." Three of the crew, however, preferred remaining on this sterile island rather than venture three thousand miles in an open boat; so leaving them a small stock of provisions and some fishing lines, the remainder of the men headed to the eastward.

For several days the boats kept together; then they became separated, never to meet again. Six weeks later a battered whaleboat drifted into the harbor of Valparaiso just as the sun was sinking across the wide reach of crimson-tinted waters. The glory of the sunset bathed the stained and tattered sail until it looked to be woven in threads of gold. Even the gaunt faces of the crew, caressed by tender touches of the mystic glow, became fair to look upon, and their ragged vestments seemed to wrap them about with the raiment of a king.

Upon learning the story of the shipwreck, an American man-of-war, then at anchor in the harbor, was dispatched to Ducie's Island, where the three men were rescued.—Harper's Young People.

The Decline in Price of Electrical Equipments.

In commenting on the business situation and the decline in prices of electrical apparatus, the Electrical Review says: "Six years ago the price for a complete equipment for a trolley car, including two motors, was about $4,500. This price held for a year and a half and then dropped to $3,850, $3,500 and $3,300, until two years ago it was about $2,850. One year ago $2,000 was the price of the same equipment, greatly improved in quality and efficiency, while to-day the average price is between $1,000 and $1,200. We have been told of an electric railway manager who desired quite recently to purchase an equipment for a single car. He wrote to seven manufacturing companies, and immediately was called upon by seven salesmen, all of whom had paid traveling expenses to try for the order. The prices quoted ranged from $1,500 to $640. The manager bought the $640 apparatus. Here we have a decrease in actual selling prices from $4,500 in 1888 to $640 in 1894, a period of six years. In 1888 there were seven electric railways in the United States. In January, 1890, there were 162 electric railways in operation and in process of construction. In January, 1891, this number had grown to 281, while to-day there are probably over 500 cities in the United States equipped with electric roads, many of them of great mileage, as in Boston, Brooklyn, St. Paul, Minneapolis and Cincinnati.

"This marked reduction in the price of railway apparatus during the short period of six years is due largely to competition between manufacturing companies, but chiefly to a reduction in the cost of manufacture, accompanied by an increase in the quality of the product. The margin of profit on the equipment mentioned at $4,500, in 1888, was not as large as it was on a better equipment at $2,850, in 1893, owing to the reduction in the cost of the manufacture. While prices have been fearfully cut during the last year by all the manufacturing companies, partly due to intense competition and partly to the business depression, we do not believe that any company can make and sell a satisfactory car equipment for $640 and clear a profit on it."

Commodore Barron's Prow Ship.*

A model of Commodore James Barron's prow ship was exhibited in the rotunda of the Capitol at Washington in 1836, and is now preserved in the Seamanship building at the Naval Academy, Annapolis, Maryland. Its inventor thus described this, the first steam ram ever proposed, under date February 11, 1836:

"I would propose that a vessel be constructed of solid logs of light timber, the gravity of which would not exceed four-tenths that of water, and be of such bulk that the upper part of the solid log work of the center vessel would float six or eight feet above its surface.

"Let this vessel, or combination of vessels, be of large dimensions, say from one hundred and fifty to two hundred or two hundred and thirty feet long, and seventy or eighty feet wide, and resembling in their form a steamboat of the treble construction. The prow should be very strong, and for a few feet aft a little sharp; but not so much so as to impair its strength. The point of it should not be reduced to a less thickness than three or four feet, and not exceeding in its whole length beyond the bow of the center vessel fifteen or twenty feet, and that prominence covered with iron plates from three to four inches thick, eight or ten inches wide, and six or eight feet long on each arm, formed into an acute angle to fit the shape of the prow, and enlarged at their junction on the point of the prow to about eight or ten inches in thickness, and rounding outward in sharp pointed knobs, cut in large diamond form. These plates should be placed four or five inches apart from each other and let half their thickness into the wood, which will produce a saw-shaped space upon the prow, and prevent the glancing of the vessel from her object, either up or down or sideways.

"The logs that form the prow should be at least two feet square, thirty or forty feet long, and of the hardest and toughest wood, such as oak or elm, and occupy a space of ten or twelve feet up and down, and be supported on each side by the same kind of timber. The iron plates should be securely bolted through the whole mass, but particularly so through these logs of hard timber. To protect the crew and machinery from shot, let the guard vessels without the center vessel be built twelve or fifteen feet wide, and of solid white pine timber, and projected asufficient distance from the sides of the center vessel to embrace the paddle wheels. These barricade vessels should be of sufficient elevation to cover the upper part of the paddle wheels. Each of the lower parts must form a bottom similar to the center one, and be secured to it forward and aft by the cross logs of which the center vessel is constructed, projecting from her sides to such a distance as to allow spaces for the paddlewheels on each side, and from as many points above the water between the paddle wheels as might be required for strength.

"The water is admitted to these paddle wheels between the bows of these vessels through a channel formed by a long inverted arch, the lowest point of which must descend below the level of the lower part of the wheels. The solid log work, forward and aft of the center vessel, should form a mass of at least twelve or fifteen feet in thickness, or as the side vessels.

"Over the top of these vessels lay a tier of logs about two feet square, which will serve as a protection to the crew and machinery from any assaults by boarding, etc. The middle vessel may be hollowed out, at a proper distance from her extremes, if more buoyancy is required than the timber itself gives, except amidships, and there the log work should be continuous from the prow all the way aft.

"The object of this vessel is to destroy men-of-war by running into them with such impetuosity as to break down their sides sufficiently to admit water in such quantities as would defy all possible efforts to prevent immediate sinking.

"Only about ten or twelve feet of the prow of this vessel ought to be allowed to strike the ship that is assailed; the other parts, above and below, should recede or incline aft, and this ten or twelve feet space should be so situated as to come in contact with the side of the enemy five or six feet above the water and five or six feet below its surface. The resistance to the stroke would be less impeded than it would be were it given by a prow of greater extent, and of course it would be more certain to pierce or break down that part of the side of the enemy's ship which it might come in contact with. Three steam engines of one hundred and twenty horse power each would propel such a vessel at the rate of eight or ten miles, or more, per hour, and should be preferred to larger ones, as they would be less liable to damage from the shock to which they might be exposed when the vessel should come at her full speed in contact with the enemy.

"Let those who are curious or doubtful of the efficiency of this plan calculate the effect which would be produced on a stationary body by a concussion so violent as would be occasioned by a stroke of the prow of this massive vessel. To make it apparent that the strongest ships in the world are entirely inadequate to resist such force, it need only be observed that they seldom come in contact with each other with any violence without sinking or sustaining a most destructive degree of damage.

"Ancient as well as modern history furnishes us with many proofs of the decided effects of this mode of attack. The Romans and Carthaginians were in the practice of running into each other's vessels at their greatest speed, impelled by their oars; and it is recorded of them that when they found their enemies entangled with their friends, so as to render them stationary for the moment of their assault, that it seldom failed to produce that description of destruction contemplated by the adoption of this invention; but the power of steam and the solid construction of this vessel would give this mode of attack a decided advantage over all other attempts of a similar nature ever heretofore resorted to, and beyond a doubt insure success.

"The proof of the effects of an attack made by a whale on the ship Essex, of New Bedford, in the year 1819, is conclusive that no construction of a ship now known could resist the shock of such a vessel as the one I have described. A circumstance not very dissimilar occurred to Captain Jones, in the United States ship Peacock, in the Pacific Ocean.

"The instances of destruction occasioned to vessels by one running into another are too numerous to admit of a doubt that if the plan recommended above should be adopted on a proper scale, it could never fail of effecting its object.

"The rudder is attached to the center vessel, and must be moved by a wheel which may be placed on the upper surface of the center vessel, under the roof or main covering, either forward or aft; but I should prefer its being aft, and it should be considerably forward and lower down than in ordinary cases.

A breastwork should be raised aft, for the protection of officers and others; also for the chimneys and steam pipes, in their proper places, which should be circular.

"The timber alluded to in the above description is the white pine—'Pinus strobus'—poplar—'Liriodendron tulipifera'—and some species of the gum, none of which exceed four-tenths of the gravity of water.

"The prow mentioned in the first part of this description is not of such a form as I would either use myself or recommend to those whom I would allow to use my invention; that form might become fixed in the body assailed, but the form represented by the drawing will surely clear itself.

"In speaking of the different presentations of the prow and its momentum, it is to be considered as in contact with a solid body.

"Dimensions, etc., of the steam prow ship:

	"Length. Feet.	Width. Feet.	Depth. Feet.	Number of Cubic Feet.
Middle vessel	150	20	30	90,000
Side vessels	each 125	12	30	both 90,000

"Number of cubic feet in the three vessels, 180,000.
"Weight of each cubic foot of white pine in the three vessels, 24 pounds.
"Specific gravity of the three vessels 4,320,000 pounds, or 1,963 tons.
"Specific gravity of the three vessels multiplied by their velocity gives as the whole momentum of the three vessels, 43,200,000 pounds.
"Momentum on each foot of the prow, 900,000 pounds."

*Abstract from "Origin and Development of Steam Navigation," by Rear Admiral George H. Preble, U.S.N., in the United Service.

The Camphor Tree.

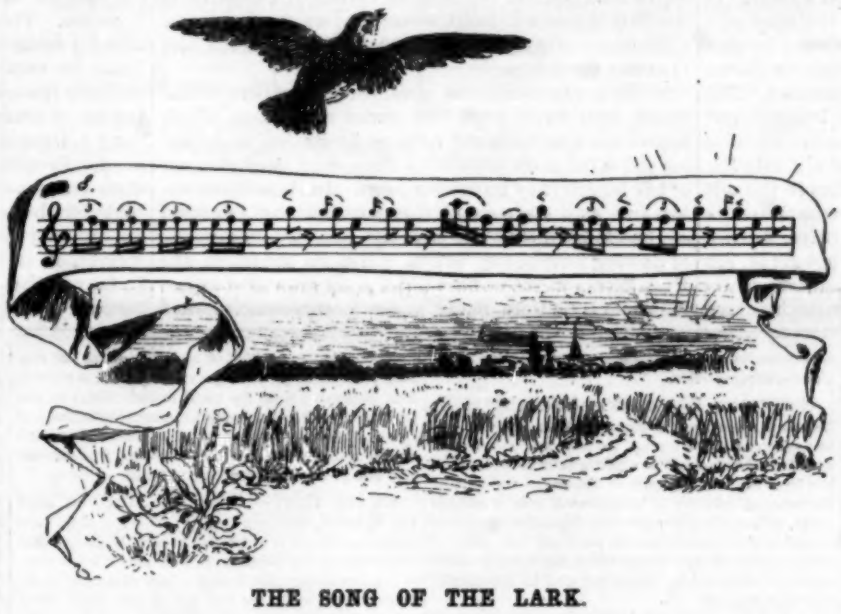
While camphor was formerly produced in Sumatra, Borneo, and other parts of the East Indies, all now known to the trade comes from Japan and Formosa. The camphor tree is a large evergreen of symmetrical proportions, somewhat resembling a linden. It bears a white flower, which ripens into a red berry. Some of the trees are fifteen feet in diameter and live to a great age. A group of trees in the province of Toosa, about a century old, are estimated to be equivalent to about forty thousand pounds of crude camphor. The camphor is extracted from chips taken from the roots or from the stem near the root, the wood yielding about 5 per cent of camphor, and the root a larger proportion. The annual export of Japan camphor averages about 5,000,000 pounds. The forests in Japan owned by the people are now almost denuded of timber, but the government still possesses large woods of camphor trees, which, it is estimated, will maintain a full average supply of the gum for the next twenty-five years. Plantations of young trees are also making and are well taken care of, and, although camphor has not hitherto been extracted from trees less than seventy or eighty years old, it is expected that under the present intelligent management equally good results may be realized in twenty-five or thirty years. The Japanese Department of Forests, which has the control of these woods, is under good management.

THE SONG OF THE LARK.

Since ancient times men have been trying to imitate the songs of birds by means of words and tones. The learned Jesuit, Athanasius Kircher, published in 1650 a work called "Musurgia Universalis," that treats, among other things, of the songs of birds, trying to give them by means of notes. These attempts have often been repeated, and have been most successful with the song of the lark and the nightingale, for it seems to be impossible to catch the songs of other birds in this way.

There has been much discussion as to which of these little singers deserves the palm; but that is entirely a matter of taste. It can, however, be said in favor of the lark that it begins to sing much earlier than the nightingale, often as early as February, its song ceases much later, and it is spread over a much larger region than the other. The lark breeds as far north as the 68° of latitude, on the Lofoden Islands, and lives high up on mountains, for instance, at the source of the Elbe. On the other hand, the nightingale is seldom found as far north as the southern part of Sweden, and only single birds are found in mountainous regions. In Germany it never goes higher than about 3,000 feet. Besides, the song of the lark is much longer than that of the nightingale, being, in fact, the longest bird song. The nightingale is the only bird that sings at night, and the lark the only one that sings while flying. The little lark is an untiring singer, and can often be heard after it is lost to sight. Lenau says that it "climbs on high on its golden song," but it certainly does not climb straight, rather in a very steep, narrow spiral.

There are other fine singers besides the nightingale that inhabit the forests, groves and gardens, but in the fields the lark reigns alone, for the monotonous chirping and calling of other field birds cannot be called a song. The lark is a useful rather than a harmful bird, the harm that it does by stealing a few kernels of grain spring and fall being more than counterbalanced by the good done by the consumption of seeds of weeds, insects and young snails. Therefore let us protect the singer of the fields, the lark.—Illustrirte Zeitung.



THE SONG OF THE LARK.

Explosive Mixtures.

Potassium Chlorate.—The British Druggist says: This is probably more often the cause of explosion than any other chemical which is handled by pharmacists. It should never be mixed in the powdered state with organic substances; even in very small traces in "saline" it is apt, after a time, if all the ingredients and the containing bottle are not absolutely dry, to burst the bottle and violently scatter the contents. It should never be mixed dry with tannin. Occasionally a gargle is ordered containing these ingredients; they should always be dissolved separately. Hypophosphites and chlorate similarly explode when mixed in the dry state. Chlorate of potassium and glycerin alone should never be dispensed, nor should it be combined with sulphur or the metallic sulphides.

Permanganate of potassium is another source of danger, for the same reason as chlorate—it so readily gives up its oxygen; consequently, it should not be mixed with any organic bodies, such as sugar or glycerin, nor with spirit of wine or spirituous preparations. When ordered in the form of pills, it should be massed with kaolin and petrolatum.

Glycerin, in addition to the cases above mentioned, should not be combined with chromic acid; nor with borax together with alkaline carbonates.

Turpentines and volatile oils containing terpenes should not be combined with strong mineral acids, nor with iodine or bromine.

Iodine should never be mixed in the free state with any preparations containing free ammonia, especially when combined with fatty matter.

Oxide of silver, sometimes ordered in the pilular form, should be massed with kaolin and petrolatum, and no chloride combined with it.

Spirit of nitrous ether frequently becomes very acid in keeping; in this state, when mixed with carbonates or bicarbonates, it liberates carbonic anhydride, and, if tightly corked, the bottle is frequently burst. Such a mixture should not be corked immediately after mixing. Excess of acid in the niter may be removed by keeping a large crystal of sodium bicarbonate in the stock bottle, occasionally easing the stopper.

THE discovery of anæsthesia is due to Dr. Crawford W. Long, of Georgia, who in 1842 performed a surgical operation upon James M. Venable, Dr. Long having first rendered the patient insensible to pain by the application of ether. Two or three years later Messrs. Wells, Jackson, and Morton began their experiments, after which the anæsthetic properties of ether and chloroform rapidly became known.

Jealousy of Wealth.

The August number of the Engineering Magazine contains an interesting article on this subject by William Nelson Black, in which he says: There is a popular impression that men get their wealth by taking something out of the hands of other men and appropriating it to their own uses. There could hardly be a greater misconception. The accumulation of wealth by all the honest processes of production, or by buying and selling, is really the creation of wealth; the production of something that would absolutely have had no being had it not been for the personal exertions of its creator. Yet this fact is only dimly comprehended by most men who bother their heads with social problems. Sometimes it is not comprehended at all. Men seem to go upon the assumption that there is just so much wealth in the world, and that life is a struggle to see who shall make the largest grab. But as a matter of fact the fortune of every man who earns money by lawful means is simply his part contributed to the total of the national or social wealth.

Take the career of George M. Pullman, just now a conspicuous target for the abuse of addle-headed labor leaders and Populist cranks and "reformers." Starting as a poor boy, through sheer force of inventive genius and masterful business capacity he has amassed an enormous fortune. But every dollar represents new wealth, and no man has ever dared to cast a suspicion upon the character or methods of the man. In fact, William T. Stead, the sensational English editor and reformer, who lately had so much to say in favor of the poor and against the rich and the corrupt elements of Chicago society, when it came to Mr. Pullman, found it necessary to say this:

"The first Pullman car which he constructed and put on the rails cost $18,000 to build, as against $4,000, which was the price of the ordinary sleeper. Railway men shrugged their shoulders. It was magnificent, they said, but it was not business. A palace sleeping car at $18,000 could not possibly pay. Mr. Pullman refused to be discouraged. 'Let the traveling public decide,' was all he asked; 'run your old sleepers and the new ones together; I will charge half a dollar more for a berth in the Pullman, and see which holds the field.' The verdict of the public was instant and decisive; every one preferred the Pullman at the extra price, and the success of the inventive car builder was assured. He has gone on step by step, from car to car, until at the present moment he is said to have a fleet, as he calls it, of nearly 2,000 sleepers, which are operated by the Pullman Company. They have besides 58 dining cars and 650 buffet cars. Altogether the cars which the company operates number 2,573. Other competitors have come into the field, but Mr. Pullman deserves the distinction of having placed every railway traveler under an obligation by acting as pioneer of commodious, luxurious, and safe railway traveling.

"After building his cars in various parts, Mr. Pullman decided finally to centralize in the center of the American continent. Carrying out his decision, he naturally fixed upon Chicago as the site for his works. The Pullman Company was incorporated with a capital of $30,000,000, the quotation for which in the market today is twice that amount. He took up an estate of over three thousand acres round Lake Calumet, which is fourteen miles from the center of Chicago, and which was at that time far outside the city limits. There, following the example of Messrs. Krupp at Essen, he set to work to construct a model city in his own image. The car works were, of course, the center and nucleus of all. In these gigantic factories, where 14,000 employes work up 50,000,000 feet of lumber every year, and 85,000 tons of iron, they have a productive capacity of 100 miles of cars per annum. Their annual output, when they are working at full stretch, is 12,500 freight cars, 313 sleeping cars, 636 passenger cars and 980 street cars."

Now all this enormous accumulation, representing millions in value, affording profitable employment for thousands of people, and conferring grateful comfort upon millions of travelers—all this had no existence when Mr. Pullman began, and it has all been created under his immediate personal direction. To say that his employes did it, or that it would have been done by some one else, is equivalent to saying that Napoleon was not necessary to his work, or that electricity would have reached its present practical development without the aid of Morse and Edison and Bell!

Or take the case of Jay Gould. This much-abused millionaire left a fortune estimated at $70,000,000, the product of a life of great activity in planning and executing works of public utility which continuously employed whole armies of men. But will any man doubt that he contributed the full total of $70,000,000 to the national wealth? Will any man doubt, indeed, that he contributed several times the amount of his own fortune to the total? Consider the wilderness reclaimed, the new towns that have grown into importance along his lines of railway, with their increase in the values of real estate, the manufactures promoted, the contractors enriched, and the various other incidental profits that follow upon the prosecution of great works. Were it said that Jay Gould contributed $500,000,000 to the national wealth during the forty years of his active career, the estimate would not be excessive.

What is said of Jay Gould could be said in different terms of Commodore Vanderbilt, whose fortune, now enlarged in the hands of his family, causes so much jealousy. He contributed to the total of wealth vastly more than he secured for himself, and it is reasonable to presume, much more than his entire family of the third generation now holds in its possession. So with many other men of his kind, and in this field of research examples crowd upon us. The Bell Telephone Company, the electric light companies, and the electric railway companies are all very recent representatives of a wealth that would have been non-existent but for the inventive talents and enterprise of their promoters. But even here, too, we must make large estimates for an incidental increase in values. The electric railways are penetrating the suburbs of all our large cities, and by making them more accessible they are adding incalculably to suburban wealth. Yet not a dollar is taken from the public for which an equivalent is not given, either in the form of greater convenience or in actual profits.

The first thing that every man is forced to do when he sets out to make a fortune is to employ somebody to help him; and the more ambitious he gets, the larger and larger becomes the number of his assistants. Some are directly engaged in the promotion of his plans, and draw their compensation directly from his pay rolls; but by far the larger number are indirectly engaged, and remain invisible to all except the economic analyst. The wholesale merchant, for example, seems to employ only a few quilldrivers and truckmen; but his employes are sometimes scattered all over the world, and it is due to his thirst for wealth, and the thirst of other men in kindred pursuits, that these distant employes can find a market for their labor. It will be seen, therefore, that no man can pursue wealth exclusively in his own interest, however selfish he may be; and when one sees how little there is beyond the reach of men of modest but competent income that the man of large fortune can enjoy, he is led to wonder sometimes at the assiduity of the pursuit. But habit has a great deal to do with it, and the needs and aspirations of a family impel the richest man to further exertion. In this country men rarely retire from business until they die, and it is fortunate for the community that this is true.

From the material point of view these men are the most useful members of the community, and the man is either a public enemy, a fool, or both who seeks to obstruct their operations. The writer could not write, the painter could not paint, and the laborer would literally be forced to go fishing were it not for the forces which the wealth seekers put in operation. The very genius of progress, under the free institutions that we enjoy, rests upon the principle of great rewards to those who accomplish great works; and whatever else may be wrong in our social and economic system, we cannot afford to discourage, much less dispense with, the great "captains of industry" who marshal the forces of labor and lead us on toward the golden age that will see the race emancipated from poverty.

ICELAND is one of the few countries that has a smaller population now than it had twenty years ago.

The Teredo Navalis in Boston Harbor.

At the meeting of the Boston Society of Civil Engineers, reported in the Journal of the Association of Engineering Societies, Mr. Henry Manley said: The Eastern Dredging Company had two large scows built last season in Bath, Me., of pine, which were brought to Boston, where they were measured. They were taken down to the mouth of the harbor, beyond Boston Light, on or about May 27, for dredging, and were used there during the summer. In October, or early in November, they began to leak; but by that time the owners had begun to suspect that something serious was the matter, and the one in the worst condition was brought up the harbor. It was found pretty thoroughly bored through by teredo navalis, and had to be practically replanked. Another scow was then brought up, and was found riddled through, though not so badly, by the teredo. The teredo has for a long time existed on the southern coast of New England; but our harbor, on account of the difference in the temperature of the water, was supposed to be exempt. This case is almost the first in which they have been found so far north, and is the first in which they have done any appreciable harm. There are some curious features in the life and nature of the teredo. The full grown animal sometimes attains a length of two or three feet. It enters the wood through a very small hole, and after that passes its life inside, penetrating the wood as it grows; but living, in one sense, a solitary life, as the openings never communicate with each other. The eggs are formed in the interior of the animal in position, and are fertilized there. They are hatched in the water. While the animal is in the water it passes through two or three different stages of growth, in each of which it assumes a different form. In one stage it is able to swim. In a later stage it has a foot that enables it to cling to any object and to move about to a limited extent. It enters the wood when about as large as the head of a pin. After it makes its entrance into the wood its progress is quite rapid. The four or five inch plank shown has been torn to pieces during one summer. The teredo does not eat the wood, but simply bores it out for a habitation. It has two flues or passages running the whole length of its body and opening out into the salt water. Through one passage it takes in the salt water with the infusoria, etc., which constitute its food, and through the other tube the chips, its own excreta, and everything else it wishes to get rid of, are passed out into the water. The animal is technically a bivalvular mollusk. Its boring apparatus is a very curious one. The two large shells are not firmly hinged together. Indeed, in the specimen shown they seem to be quite loose from each other; but judging from the amount of work it can do in one season they must, in the living animal, be connected by very powerful muscles. The instance recorded may be an isolated one, or it may be the beginning of a terrible pest that will cause great trouble for all time to come to those who have charge of submarine woodwork in this harbor. Among the preventives in common use, covering with copper and creosoting are the most effectual. Creosoting is valuable only for a certain number of years.

Navy Steam Launches.

In the report made upon the 39 foot Herreshoff steam barge belonging to the Chicago, by Captain A. S. Barker, U. S. N., commanding the U. S. S. Philadelphia, it is stated that "The steam turnabout launch, which is a lifeboat, is an excellent, buoyant, and seaworthy boat, her maneuvering qualities being exceptionally good, excelling in this respect all the steam launches in the fleet, for which reason alone she commends herself to the service. The boat has been in constant use since we have had her, and has done excellent work. . . . Where two steam launches are supplied to a man-of-war, I would recommend that one of them be of this type, on account of her safety and maneuvering qualities."

In the tests made by the Board in November, 1892, with a crew of eight men, and allowance of coal and water (making a total weight of 1,673 pounds) this boat showed a freeboard of 45 inches forward, 29 inches aft, and 22 inches amidships. With 35 men seated and supplementing the above weight, a freeboard of 44 inches forward, 21 inches aft, and 19 inches amidships was maintained; and with 50 men in addition to the above 1,673 pounds, the steamer turned and speeded in the East River (wind and water moderate), preserving a freeboard of 36½ inches forward, 22 inches aft, and 17 inches amidships.

So far as seaworthiness goes, three members of the board who have tried her under conditions which tested this quality fairly have no hesitation in declaring she is far more seaworthy than any other steamer of her length they have ever seen. In these trials she was run at a high speed through the most confused sea (made both by wind and the tumbled crosswakes of passing ferryboats) which could be found in the East River, and at no time did she ship the least water. All these tests were made under circumstances when every other steamer of her length known to them would have become so wet and so much in danger of shipping water as to have necessitated an immediate and large reduction of speed.

Under a test for life-saving qualities, very satisfactory and unusual results were secured. The machinery and passenger spaces were filled with fresh water up to the level of the rail, so high indeed that it flowed with force through the scuppers in the wash strake, and then as an appreciable freeboard still existed, over 2,200 pounds of weight (15 men) were added without submerging the boat.

These results have been partly secured by making her not a nominal, but an actual lifeboat. Under the rail, on each side, two cylindrical air tanks extend for a distance of 13 feet, and in the bow and stern two air-tight compartments are disposed. The square shape given to the stern affords room for one of these air-tight chambers, and thus utilizes space which generally is wasted upon a mistaken theory as to what is good appearance. Three complete water-tight bulkheads subdivide the boat and add large margin to an already secured factor of safety.

An Aluminum War Boat.

An aluminum boat, the Jules Davoust, which has been sent out to the Niger by the French government for hydrographic purposes, is reported to be an entirely successful experiment. It weighs about 4,400 pounds, and has a capacity of 11 tons, with a draught of about 15 inches. It is about 40 feet long, 6 feet wide, and 2½ feet deep. There are three masts and a deck cabin, as well as a movable deck tent, or pavilion. The sails are of the lateen order and easily managed. Two Hotchkiss quick-firing guns are mounted amidships. The vessel was built by Lefebvre, of Paris, who has already furnished several dismountable vehicles of this metal for the use of the French troops in the Soudan and Tonquin. The lightness of the material makes it valuable for such uses in wild and unexplored countries, as boats or vehicles made of it can be easily carried through the bush. Word comes, also, from France of the use of aluminum for cabs in Paris, where the company L'Urbaine, who own the largest number of hacks in the French capital, are about to use the metal in their construction. The company are now using tin plate for the bodies of their cabs. It is reckoned that an ordinary coupe weighs about 1,000 pounds. This weight, it is expected, will be greatly reduced if it is found that the aluminum cabs are a practical success.

RECENTLY PATENTED INVENTIONS.

Engineering.

BOILER FURNACE.—Zenas E. Moon, Schuyler, Neb. This invention provides a furnace and attachments, applicable to any ordinary horizontal boilers, of such construction that the atmospheric air may be taken from the ash pit and delivered in a heated condition into the fire box, and also into the furnace behind the bridge wall, the air mingling with the unconsumed gases to promote more complete combustion. It is also provided that the heat may be more evenly distributed upon the heating surface of the boiler, for the quick generation of steam and prolonging the life of the boiler.

DREDGER.—Samuel P. Hedges, Greenport, N. Y. This is an improvement upon a formerly patented invention of the same inventor, providing a simple device for holding back, lowering and controlling the outward movement of the dipper handle. The dipper is allowed to enter the soil without a sudden jar or drop, and the position of the lower end of the dipper arm may be controlled, to fall either perpendicularly or with any desired inward inclination, the manipulation of the dipper being under the complete control of the operator.

CENTRIFUGAL BLOWER.—William H. Harrison, Newark, N. J. This blower provides an outlet for the air from the fan wheel that is designed to prevent undue compression of the air in the wheel, and consequent friction and loss of power. The invention consists of a fan wheel having a series of plane radial main vanes forming a passage for the air from the central opening of the wheel to its periphery, while a set of parallel auxiliary vanes is arranged for each main vane, extending from the periphery of the wheel to within a short distance of the next following main vane.

Electrical.

BUSHING FOR ARC LAMPS.—Thomas J. Houck, Baltimore, Md. This is a detachable and adjustable bushing for carbon holder guides, and one which may be tightened or adjusted from time to time to take up wear and always hold the upper carbon holder and its carbon in true vertical alignment, at the same time avoiding the necessity and expense of throwing away the old guides and replacing them with new ones. The improved bushing has longitudinal slits forming spring tongues, and has on its exterior a tapering screw thread adapted to compress the spring tongues when screwed into a socket.

AUTOMATIC LINE DISCHARGER.—Jacinto F. Gandazer, Gracia, Spain. According to this invention an electro-magnet, an armature lever carrying an armature and prolonged between a pair of electrical contacts, a retractile spring for holding the armature lever normally against the back contact spring, and line and ground connections, are combined in an automatic device for insertion in electrical lines, to discharge the lines when an abnormal current passes, as when lightning strikes a telegraph, telephone, or electric light wire, or when a conductor carrying a heavy current crosses a telephone or telegraph line.

GALVANIC ELEMENT.—Albrecht Heil, Crumbach, Germany. A silver electrode attached to a lead support is sealed through the cover and embedded in a mixture of carbon and peroxide of manganese, inclosed in a linen bag, a felt cylinder or diaphragm surrounding the same, and adapted to be saturated with a suitable liquid. It is designed to render the element proof against oxidation of the binding screws, small and convenient in shape, with relatively powerful action, hermetically closed to prevent evaporation, cleanly and nice in appearance, and easy to make.

Mechanical.

SAND BLAST MACHINE.—John A. Shoemaker, Rochester, N. Y. This inventor has devised improvements in machines adapted to produce non-lustrous surfaces on previously polished buttons and other small articles, or for general use. Means are afforded to rapidly and perfectly sand blast a considerable number of buttons at one time, the machine being adapted for continuous operation, the articles operated upon being readily placed and removed, while the operator is enabled to gauge the force of impact of the sand blast and graduate the amount of sand pervading the air current used to effect the blast.

NUT LOCK.—Elmer J. Bickell, Jersey Shore, Pa. Combined with a longitudinally grooved bolt, and a nut having a circumferential groove near its lower side, is a locking piece comprising an annular plate having an integral key formed at the edge of its center hole, and fitting in the groove of the bolt, in connection with two sets of inclined spring fingers, one set projecting up to interlock key notches at corners of the nut and the other set extending down to be seated on material penetrated by the bolt.

LIFTING JACK.—Allan A. Smith, Grand Island, Neb. This jack has an elongated body or base, with which is connected a lifting device, while a ring slidable vertically on the base has a lateral flange adapted to engage the rim of a car wheel, the jack being designed particularly for railroad use in lifting the journal boxes of cars to enable the brasses to be removed, although it may be used for ordinary lifting purposes

Miscellaneous.

SEWING MACHINE ATTACHMENT.—Ferdinand B. Almy, Providence, R. I. This invention relates to a presser foot attachment similar to a former patented invention of the same inventor. The improved attachment is capable of being secured to presser feet of various widths and thicknesses. The invention consists principally of an adjustable clamping device whereby the attachment may be secured to a presser foot, and a toe which is adjustably connected with the clamping device.

PROPELLING CAROUSELS, ETC.—Charles Braaf, New York City. This inventor has devised a propelling mechanism for each car, of such construction that the occupant or occupants cause the supports from which the carriages are suspended to revolve, thus dispensing with the usual motor. There is also provided a wind motor for each carriage, in the shape of a series of sails or a winged wheel, the sails opening and closing of themselves at proper intervals. The carousel may also be used for exercising purposes.

CHAIR COT.—Colin C. McPhee and Ivor E. Brock, Chatham, Canada. This is a simple and durable construction which may be quickly changed into a comfortable and portable cot, with pillow attachment, or into a reclining chair having a back adjustable to any desired angle, and a leg rest that adapts itself simultaneously to the changed position of the chair. The covering material, of any approved character, is conveniently attached to the chair frame.

LEVEL.—Harry Hughes, Alliance, Neb. This invention consists principally of a balance lever, fulcrumed at its middle in the stock and having at its ends adjustable weights, the fulcrum pin of the lever being provided with pointers indicating on dials fixed on the stock. The balance lever is locked in position when desired, and the friction between the lever and the stock may be regulated to take up wear, the implement quickly indicating an angle when placed in an inclined position, and being of very simple and durable construction.

DRAWING INSTRUMENT.—Edmund L. Sanderson, Waltham, Mass. This is a new and improved adjustable triangle, comprising a straight edge and a blade pivoted thereon. It is of simple and durable construction, and arranged to permit of conveniently drawing lines at angle to the T-square, and also lines perpendicular to each other.

TOBACCO CASING MACHINE.—David R. Fraley, Winston, N. C. This is a machine designed to facilitate the moistening or flavoring of tobacco preparatory to its being made into plugs, more thoroughly atomizing the flavoring, and more thoroughly and uniformly agitating and distributing the leaves to receive the flavoring liquid. The machine also cleans the tobacco of all trash and dirt, and is economical of the flavoring, the sprayer having an atomizer which can be readily adjusted in relation to the character of the tobacco. The tobacco, as it is agitated and fed forward to receive the spray, is first wound in one direction, then unwound at the spraying point and rewound in a reverse direction, whereby both sides of the leaves receive the spraying uniformly.

SHELL FUSE.—Dawson Conekin, Charleston, S. C. For exploding shells in pneumatic guns, and also for exploding torpedoes, this inventor has devised a simple and economic fuse to be fired by impact at its forward end with any object it may strike, or with the water. The fuse has a spring-controlled hammer, a sectional firing shaft whose sections are separable by concussion, and a trigger connection between the firing shaft and the hammer. A safety latch provides against premature explosion, but it is so constructed that after the shell leaves the mortar or gun the rotary movement of the shell causes the latch to be automatically carried out of the way of the firing hammer.

ANIMAL CLIP OR SHEARER.—Charles and Harry Burgon, Malin Bridge, near Sheffield, England. In this implement it is the design of the inventors to relieve the part of the mechanism by which reciprocating motion is imparted to the cutters of the duty of giving to the cutters the necessary cutting pressure, thus improving the work and requiring less strength. Combined with the oscillating cutter-driving lever is a pressure lever, loosely connected to the cutter-driving lever and oscillating with it about the same axis, while having an upward bearing against an abutment, a downward bearing upon the cutter, and a downward moving bearing at its rear end upon the machine frame.

CIGAR HOLDER.—Frederick D. Van Wickel, Corona, N. Y. The drawing tube of this holder is smaller externally than usual, and extends a little distance under the end of the cigar, to which it is attached by a hinged band, the cigar also resting in a forward semicircular supporting band on the holder. A hollow point or pin projects upward from the drawing tube, upon which is pressed the end of the cigar as it is placed in the holder, and just beneath this point is a small cup-like offset to receive nicotine, and adapted to be closed by a screw cap.

HAIR PIN.—Louisa Ousey, South Wimbledon, England. This pin is formed of thin, flexible wire, with serrated edges, the parallel wires of the body of the pin being slightly curved in the form of an arc, to better fit the shape of the head than the ordinary straight pins, while the points and the loop end are each slightly bent outward, or in a reverse direction.

BOTTLE NECK.—Leonard A. Pells and Louis Steiner, Brooklyn, N. Y. According to this invention a collar held in the neck of the bottle has a seat on its outer side on which is supported a flap valve adapted to close against the seat, there being in the outer end of the neck a stopper ping having a central bore extending partially through it, side ports connecting with the bore. The arrangement is such that liquid can be poured freely from the bottle, but no liquid can be forced into it, thus preventing the fraudulent refilling of labeled bottles.

AWNING WORKER.—John A. Gillin, Chicago, Ill. This inventor has designed a cheap and simple working mechanism whereby the awning may be instantly collapsed and thrown up out of the way, or as easily lowered into position for use. The mechanism is so arranged that the awning may be operated from the interior of the building, although protected from being tampered with by unauthorized persons.

BOTTLE FILLING MACHINE.—Samuel B. Smallwood, Long Island City, N. Y. Combined with a revolving tank containing the liquid is a series of filling tubes sliding in the tank, and a series of platforms in a circle in line with the filling tubes, the platforms supporting the bottles to be filled and moving with the tubes and tank. The construction permits the ready escape of the air from the bottle during the filling. A further patent has also been granted this inventor, under the same title, for an improvement designed to be

especially effective in insuring a ready flow of the filling liquid from the cask to the bottle, facilitating also the escape of the displaced air.

STOPPER.—James L. Miller, New York City. This stopper has a cork section adapted to be firmly secured to a wooden body or base, the body being also so made that a sponge, a tuft of felt, or an equivalent article may be conveniently and economically made a portion of the stopper when required.

MAKING SIRUPS. — Robert H. Hunstock Hannibal, Mo. The apparatus devised by this inventor comprises a strup reservoir within which is suspended a menstruum jacket with a reduced lower end carrying a strainer, into which fits an inner section having perforations connecting with the jacket. The apparatus is designed to produce simple medicinal and fruit sirups by cold percolation, adding in a convenient way just the required quantity of sugar, the apparatus being readily cleaned and the sirup properly filtered and clarified.

Designs.

CARPET.—John R. Cochrane, Newark, N. J. The body in this design is decorated with arched panels, with tulips, in connection with roses, thistles and small flowers, and the border has spray-surrounded panel figures similar to those in the body.

CARPET.—William F. Brown, Newark, N. J. The body of this carpet has groups of floral figures, each comprising curved bisecting sprays of small flowers, a ribbon tie and conventional foliation, the border having a horse shoe spray of small flowers tied with a bow, alternating with floral figures such as in the body.

MINER'S LAMP. — Charles D. Felix, Shamokin, Pa. This lamp is somewhat in the shape of a coffee pot, but with the back edge nearly vertical, there being an attached hook at the back.

SCARF PIN.—John H. Theberath, Newark, N. J. The head of this pin consists of outspread wings centrally in which rests a small outline face with an eyeglass at one eye, and surmounted by a diminutive stovepipe hat.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

A TEXT BOOK OF ORE AND STONE MINING. By C. Le Neve Foster. With frontispiece and 716 illustrations. London: Charles Griffin & Company, Limited. Philadelphia: J. B. Lippincott Company. 1894. Pp. xxviii, 744. Price $10.

Mining engineering is at last adequately treated in this volume, and the different kinds of work that have to be done by the miner in the way of surveying, exploiting, drainage, ventilation, lighting, etc., as well as in the treatment of ores after their excavation, are all very fully treated. The book is adequately illustrated and excellently indexed. One section is devoted to legislation affecting mines and quarries, while another chapter, illustrating the thoroughness of the author, is devoted to the condition of the miners, their modes of life and the means for ameliorating their condition and elevating them. The book in its authorship is English, or rather Welsh, but England has done so much for the mines of all the world that this fact will not tell against it.

HYDRAULIC POWER AND HYDRAULIC MACHINERY. By Henry Robinson. Second edition, revised and enlarged. With numerous cuts and sixty-nine plates. London: Charles Griffin & Company, Limited. Philadelphia: J. B. Lippincott Company. 1893. Pp. xvi, 226. Price $10.

Many of the modern processes of engineering are dependent upon hydraulic power. The American Bessemer steel industry is as regards its characteristic features largely derived from the work of Holley in applying hydraulic power to this process. In their day these classes of work were considered marvels. Of late years hydraulic power has been applied in a more and more extensive way, and to a greater variety of things, so that as the present book very fully illustrates the building of hydraulic machinery for all classes of work, it will, we believe, be found very valuable and important. The work is well indexed, and will be found very interesting reading for those interested in engineering work, as well as for the profession.

MATTER, ETHER, AND MOTION. The Factors and Relations of Physical Science. By A. E. Dolbear. Revised edition, enlarged. Boston: Lee & Shepard. 1894. Pp. xv, 407. Price $2.

Professor Dolbear, by the popular cast of much of his work in science, has become a favorite with the public. The present work, treating of the ether, naturally leads to the expression of rather radical views. It is questionable whether good is done by the assumption of the actual existence, as such, of the luminiferous ether, and whether it would not be better for scientists to accept the theory just for what it is, as a convenient handle for a quantity of facts. Professor Dolbear in the present work rather tends to fall into a way of treating the ether as a real thing, and of attributing properties to inert matter not generally supposed to belong thereto.

THE ENCYCLOPEDIA OF FOUNDING AND DICTIONARY OF FOUNDRY TERMS USED IN THE PRACTICE OF MOULDING. By Simpson Bolland. New York: John Wiley & Sons. 1894. Pp. iv, 535. No index. Price $3.

The foundryman's art is here treated in dictionary form; alphabetically arranged, a large number of terms connected with his art are here defined and explained, the definitions being so full as to really entitle the work to the name given it, an encyclopedia. The author is well known as the writer of other works on the same subject, and his title to a capacity for executing the work is given in the title page beneath his name, he being a practical moulder and manager of foundries.

HOW TO BUILD DYNAMO ELECTRIC MACHINERY, EMBRACING THEORY, DESIGNING AND THE CONSTRUCTION OF DYNAMOS AND MOTORS. By Edward Trevert. Lynn, Mass.: Bubier Publishing Company. 1894. Pp. 339. Illustrated. Price $2.50

This work is quite thoroughly illustrated, and describes the general features of different dynamos. It includes a number of illustrations and a rather short index, enough, however, to save it from the reproach of being indexless. We have no doubt that it will prove of considerable use to many, and will be found an acceptable contribution to motor and dynamo building.

A LABORATORY MANUAL OF PHYSICS AND APPLIED ELECTRICITY. Arranged and edited by Edward L. Nichols. In two volumes. Vol. I. Junior Course in General Physics. By Ernest Merritt and Frederick J. Rogers. New York and London: Macmillan & Company. 1894. Pp. xiv, 294. Price $3.

Harvard College sets an example of devoting much time to physics treated experimentally. Its entrance examination in physics, for instance, involves a large amount of quantitative work. Those who have gone through this elementary entrance course may feel that it is open to criticism in the endeavor made to avoid the use of expensive apparatus. The present work, treating of the junior course, seems open to the same reproach. It would seem as well to allow the use of more perfect apparatus, because accurate work in physics cannot be done without the best appliances. It is, however, written for a specified course, and will be extensively used by those who desire to assimilate their work to the curriculum of Harvard College.

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SCIENTIFIC AMERICAN BUILDING EDITION.

AUGUST, 1894.—(No. 106.)

TABLE OF CONTENTS.

1. An elegant plate in colors showing a residence at Plainfield, N. J., recently erected for George H. Babcock, Esq. Perspective views and floor plans. A picturesque design. Mr. E. L. Hyde, architect, New York City.
2. A residence at Edgewater, Ill., recently erected for Mrs. Eva L. Prescott. Perspective elevations and plans in colors, together with floor plans. An excellent design. M. J. L. Silsbee, architect, Chicago, Ill.
3. A residence recently completed for J. P. Clarendon, Esq., at Hackensack, N. J. Two perspective elevations and floor plans. Mr. J. E. Turhune, architect, Hackensack, N. J. An attractive design.
4. A dwelling at Erie, Pa., erected for William J. Selt, Esq., at a cost of $4,500 complete. Two perspective elevations and floor plans. Mr. C. F. Dean, architect, Erie, Pa.
5. A beautiful residence recently erected at Belle Haven, Conn. Three perspective elevations, one interior view, together with floor and ground plans. Mr. C. P. H. Gilbert, architect, New York City. A model design.
6. The beautiful residence of E. Einstin, Esq., at Pompton, N. J. Perspective elevation and floor plans. Cost complete about $30,000. Architect, Mr. Manly N. Cutter, New York City.
7. A conveniently and economically arranged suburban cottage recently erected for George W. Payne, Esq., at Carthage, Ill. An attractive and picturesque design. Perspective elevation and floor plans. Cost $3,000 complete. Architects, Messrs. G. W. Payne & Son, Carthage, Ill.
8. Perspective elevation and floor plans of a well arranged dwelling, recently erected for A. N. O'Harra, Esq., at Carthage, Ill. A pleasing design. Cost complete, $5,500. Architects, Messrs. G. W. Payne & Son, Carthage, Ill.
9. A stable at Belle Haven, Conn. Perspective view and ground plan. A unique design. Mr. C. P. H. Gilbert, architect, New York City.
10. The Club House of the Knickerbocker Field Club, recently erected at Flatbush, L. I., N. Y. Engravings and floor plans. Messrs. Parsell Bros., architects, Brooklyn, N. Y. A neat design in the Colonial style.
11. An elegant residence of A. B. Bigelow, Esq., at Cranford, N. J. Perspective elevation and floor plans. Estimated cost, $6,000. Mr. Manly N. Cutter, architect, New York City.
12. Miscellaneous Contents: The Hayes metallic lathing, illustrated.—Nonsuch Palace.—The Joseph Dixon Crucible Co.—The slate business.—New and old styles of eaves troughs, illustrated.—The Weathered hot water heaters.—Design for mantel and fireplace, illustrated.—The "P. & B." sheathing and insulating papers.—An improved vise, illustrated. —What becomes of all the lumber.—Globe ventilator, illustrated.—An improved sadiron, illustrated.

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Patent Electric Vise. What is claimed, is time saving. No turning of handle to bring jaws to the work, simply one sliding movement. Capital Mach. Tool Co., Auburn, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
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Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6183) T. C. G. asks: What power can be realized on 25 feet fall, 8 inch pipe at the discharge end, and gradually enlarging toward the top to 6 feet diameter, a turbine wheel to be used? Please give size of turbine suitable for the above flow of water and horse power. Your advice tending to better this plan will be greatly appreciated. A. The flow in the conical nozzle under the head stated, if the full head can be maintained, will be 584 cubic feet of water per minute. This should give in a modern turbine with a 17½ inch wheel an actual 24 horse power; the turbine making 394 revolutions per minute. The turbine is the most effective method of developing water power for the head as stated.

(6184) Yale and Harvard asks: How many pounds does a cubic foot of pure gold weigh, and how many ordinary men does it take to lift it? A. A cubic foot of pure gold as a casting or ingot weighs 1206·62 pounds and will require eight strong men to carry it any distance.

(6185) E. B. U. says: I have a hard rubber tray which, while washing out, hit against the faucet and broke a small triangular piece out of the side of it. Can you tell me if there is any way to mend the tray? A. Equal parts of pitch and gutta percha are melted together and linseed oil is added which contains litharge. Melt until all are well mixed; use no more of the linseed oil than necessary. Apply warm.

(6186) C. C. C. says: What is the idea in melting old tin cans? Is it to get the solder or the tin, and how is it separated? A. Sometimes only the solder is saved, then again the tin is recovered. See the following issues of the SCIENTIFIC AMERICAN: May 27, 1893; March 25, 1893; May 14, 1887; April 7, 1888; October 27, 1888; November 9, 1889; October 3, 1891; May 28, 1892; August 1, 1885; July 8, 1882; July 14, 1877; February 12, 1876.

(6187) H. R. O. asks: 1. What are the resistances of each of the following lamps: 1. A 16 candle power 52 volt. 2. A 16 candle power 110 volt. 3. A 32 candle power 52 volt. 4. A 32 candle power 110 volt. A. 1. 37 ohms. 2. 244 ohms. 3. 74 ohms. 4. 488 ohms. 2. What would be the resistance of a solid bar of German silver five inches long, one-half inch wide and one-fourth inch thick? A. About 336 microhms, depending on the temperature and on the German silver used. 3. Does the E. M. F. of a chromic acid single fluid battery vary with the size of the cell? A. No. It is independent except as regards polarization. A polarized battery drops in E. M. F. A large battery for a given current resists polarization longer than does a small one. 4. Is there any book that gives directions for winding different kinds of dynamos, such as the alternating current, direct current, multipolars, generators, etc.? A. We can supply Hering's "Practical Directions for Winding Magnets for Dynamos," price $1.25. Also Trevert's "Armature and Field Magnet Winding," price $1.50 mailed. For German silver address Queen & Co., Philadelphia, Pa.

(6188) J. R. asks for a plan by which he can steer a miniature yacht by the wind pressure on the main sail. A. Carry a tiller through the head of the rudder post so as to extend astern as well as forward. Attach two springs athwartship to the forward end so as to pull it straight, one spring leading to starboard, the other to port. Attach the end of the main sheet to the after end of the tiller. As a blow strikes her, the main sheet will ease off, and the helm will be put up, thus preventing her from going in stays. You will have to experiment a little to get the proper strength of spring, etc.

(6189) W. J. W. writes: How much resistance does water offer to the passage of an electric current, also that of ice? Why is such a high ampere current used on the street car trolley system, such as 500 amperes, and on the arc light system only 10 amperes and 2,000 volts are used? Could not one be used in either place? And is the size of the wire immaterial to the number of volts forced through it? A. The current on a street car system is perpetually changing and is not constantly 500 amperes. The size of a wire is independent of the voltage it can maintain under proper conditions. Pure water and ice are of almost infinite resistance.

TO INVENTORS.

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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For which Letters Patent of the United States were Granted

August 7, 1894,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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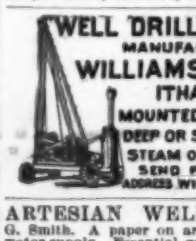

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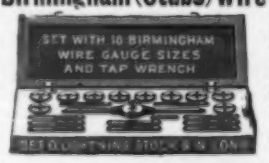

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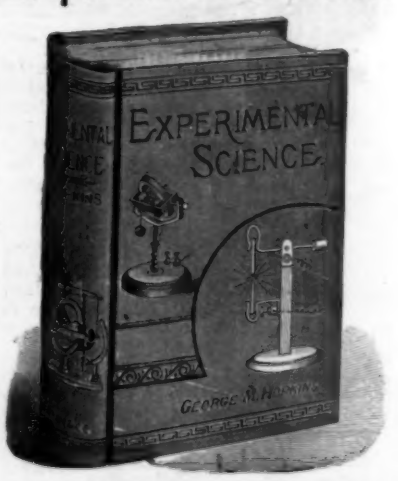

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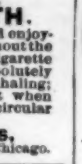

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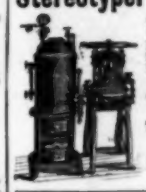

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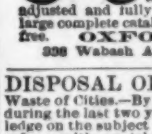

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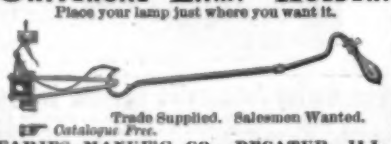

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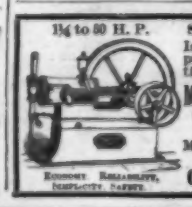

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